NATIONAL EDITION

Food Industries

Office of the Director,
Indian Institute of Fruit Technology,
DELHI.

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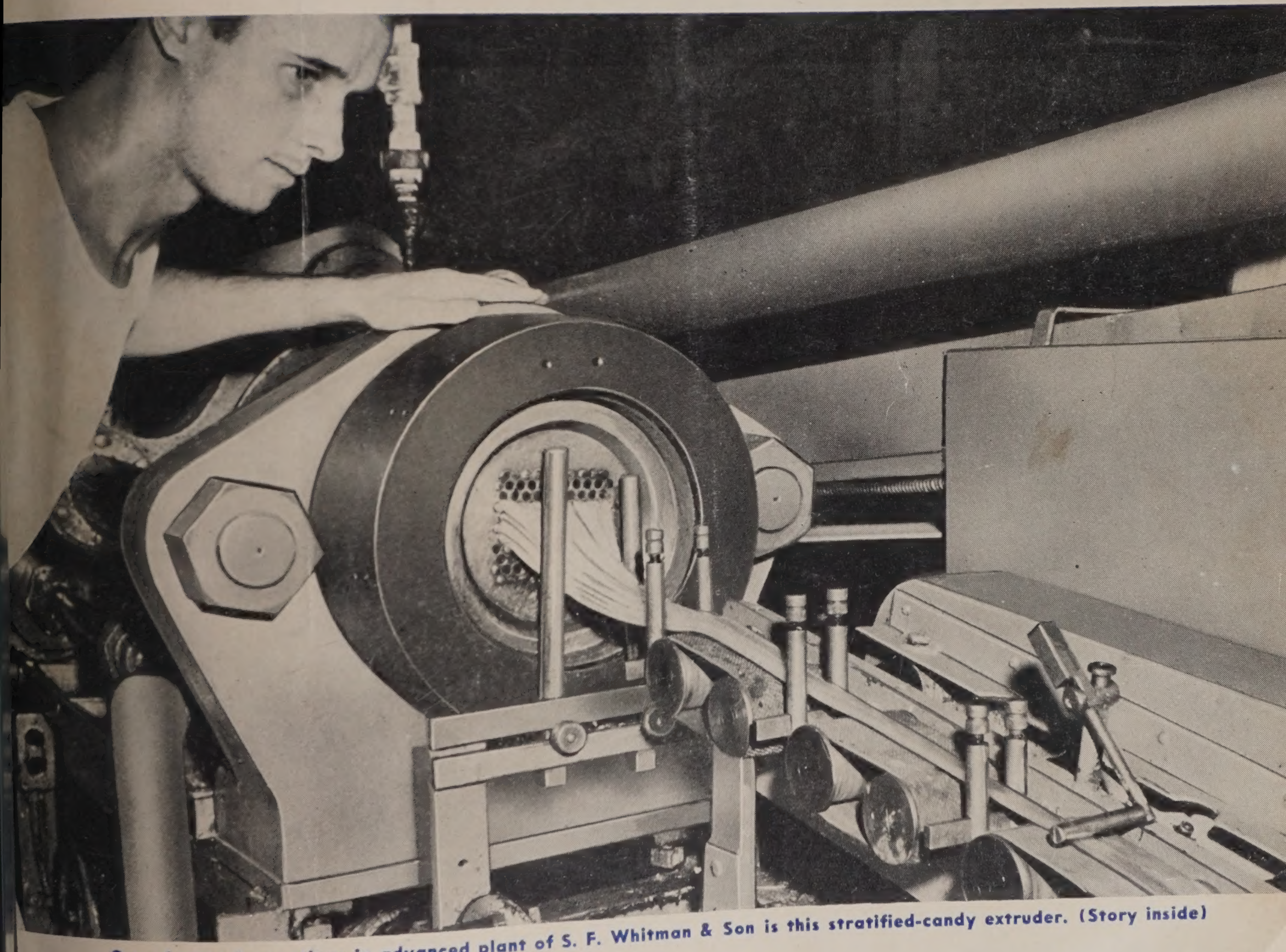
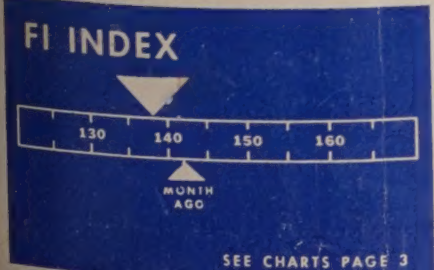
For those who control quality and costs through management and production — a McGraw-Hill publication



One of many innovations in advanced plant of S. F. Whitman & Son is this stratified-candy extruder. (Story inside)



DECEMBER, 1949: More cost-cutting articles, Report on deaeration, Removing metals from foods, New lard process, Engineering, Annual index

THE DALMATIAN, originally bred to run with coaches and carriages, may suffer from technological unemployment today but he is still popular. He is a loyal, one-family dog.

The pure breed is white with either brown or black spots, round and varying in size. He should measure 19 to 23 inches in height.

PEDIGREE CERTIFICATE
THE AMERICAN KENNEL CLUB

Name of Dog Mark-O Cinderella's Prince
Sex Male
Stud-Book No. N56,850
Vol. 66
Color White and black
Breed Dalmatian
Date Whelped October 25, 1948
Breeder Mark-O Kennels

Hollow Hill Dipper A384023
Hollow Hill Boots
Hollow Hill Dancer A455203
Hollow Hill Rooster A260987
Hollow Hill Buttons A186640
Mademoiselle De Lind C.D.
Sawyers Commando A781558

The foregoing is a true copy from the records of the American Kennel Club

In witness whereof, the Official Seal is affixed

For Safety in Shipping

Buy the Box with a Pedigree

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8
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THIS BOX CONFORMS TO ALL CONSTRUCTION REQUIREMENTS OF CONSOLIDATED FREIGHT CLASSIFICATION
BURSTING TEST 175 LBS. PER SQ. INCH
SIZE LIMIT 60 INCHES
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BORDEN'S Grated American Chees is one of many famous nationa brand products shipped by truck, rai water or air in Union corrugated con tainers—the boxes with a pedigree.

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So, for safety in shipping, do a many makers of national brand products do—call on Union. 75 years o leadership in package engineering and mass production techniques is assurance you will get the right box for you product at the right price, delivered where you need it *when you need it.*

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Since 1872

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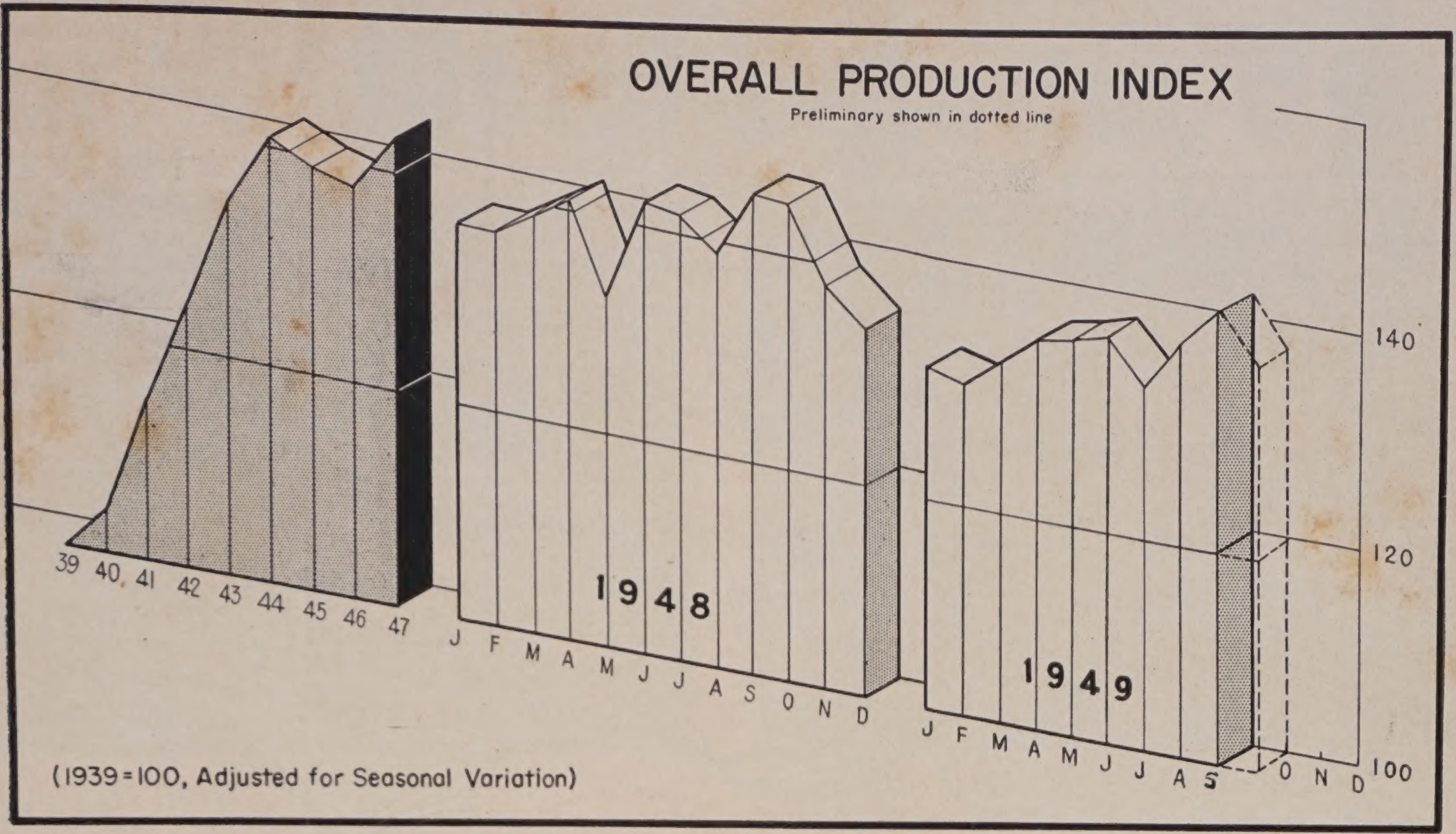
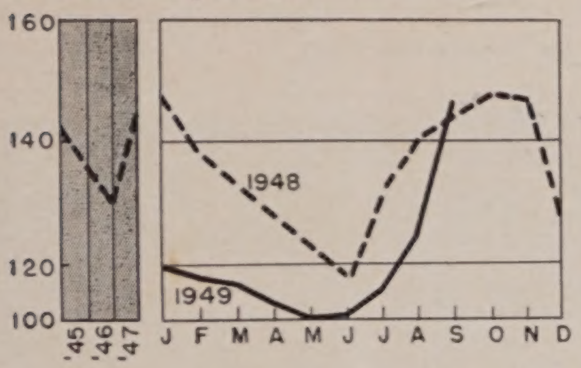
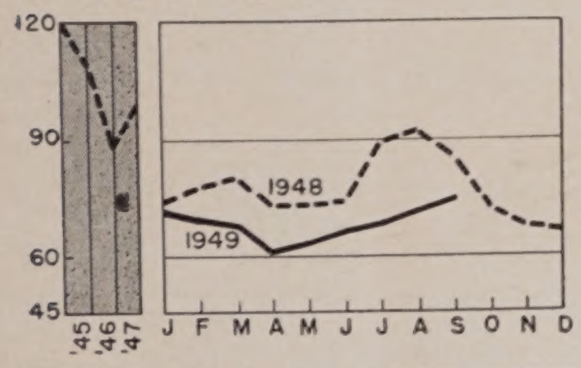
FI Index and Outlook



Confectionery Zooms



Cane Sugar Going Up



At a Glance—

(1939 = 100, With All Figures Adjusted for Seasonal Variations)

	September 1949	August 1949	Percent Change	Year Ago
Baking	147	144	+2	143
Beverages	169	173	—2	168
Butter	74	75	—1	57
Canning	127	130	—2	145
Cereals	163	166	—2	130
Condensed Milk	171	174	—2	172
Confectionery	147	125	+17	144
Flour	126	125	+1	130
Ice Cream	172	174	—1	174
Malt Liquors	173	176	—2	161
Margarine	300	311	—4	302
Meat Packing	149	142	+5	159
Sugar, Beet	68	65	+4	111
Sugar, Cane	75	71	+6	86

Overall Food Output Declines Despite Confection Gain

PRELIMINARY figure of 138 for October brings to a halt the rise in total food production that set in after the July low point. September final was 142.

Confectionery leads the parade in the commodity indexes, showing a 17 percent rise in September. A combination of factors appears to be at work in bringing about the candy increase. Output has been exceedingly low throughout the year, and much of this increase is simply a "catching up" operation. The drop in cocoa prices and stable supplies of sugar have also contributed.

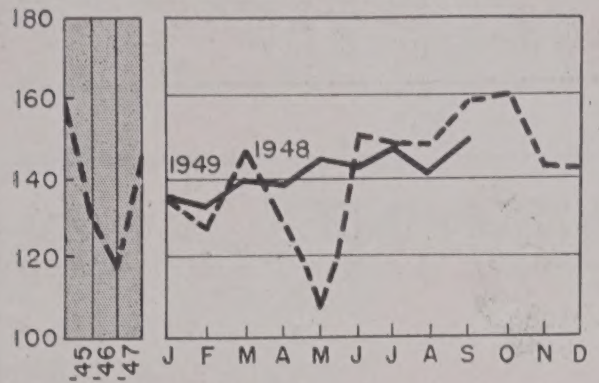
If the fourth quarter continues the improvement made in the third quarter, then 1949 will go down as another big year for the processing industry as a whole. Domestic food consumption has probably equalled or exceeded last year. The declines which have taken place in production are largely attributable to reduction in stocks, in contrast to the inventory rebuilding which went on in 1947 and 1948. There has also been some drop in food exports.

Total consumer expenditures for food seem likely to match 1948 levels in the first part of 1949. But there may be important variations in the demand for particular food products. Among the factors influencing shifts in consumer preferences are: (1) Tendency of many households to economize on food purchases after free spending in recent years, (2) falling prices for some foods, which make these foods attractive to budgeters, and (3) the search for convenience, which favors foods that are easy for housewives to prepare.

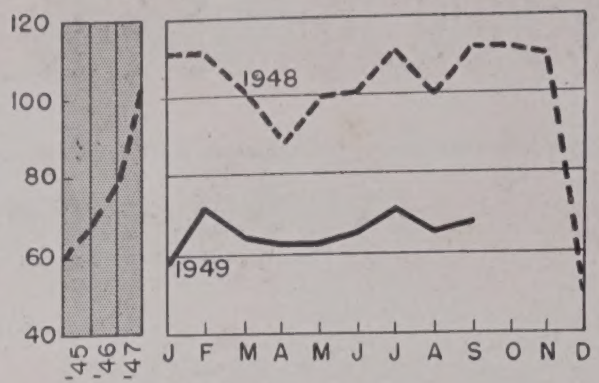
The trend toward cheaper eating has not caused any drop in total food sales because the number of consumers is still increasing through population growth. But it is an important fact for food producers to note. At the peak of the postwar boom, consumers were spending close to a third of their income-after-taxes for food. The current rate of spending is only about 27 percent of income. And the prewar average ratio was only 23 percent, indicating that some further decline may occur. Per capita consumption of food has changed little in the past three years.

Meat is one of the products favored. With prices falling, consumption has

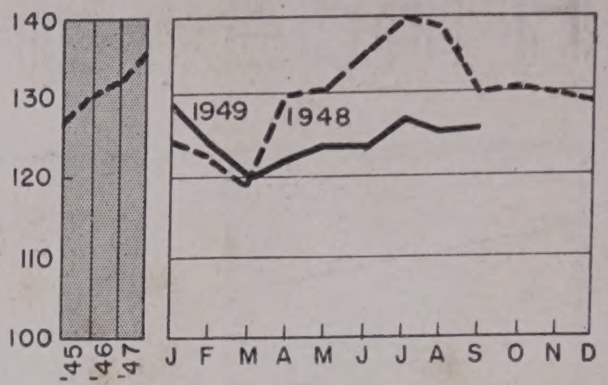
Meat Packing Climbs Back



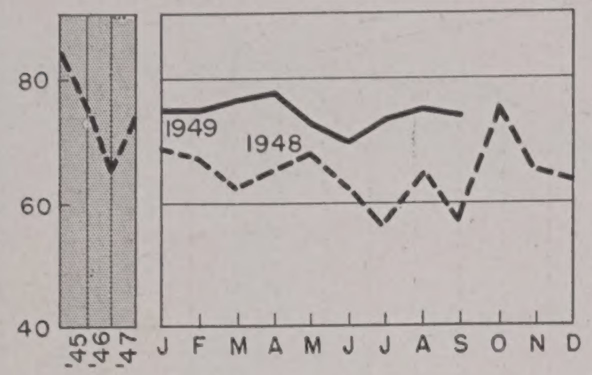
Beet Sugar Rises



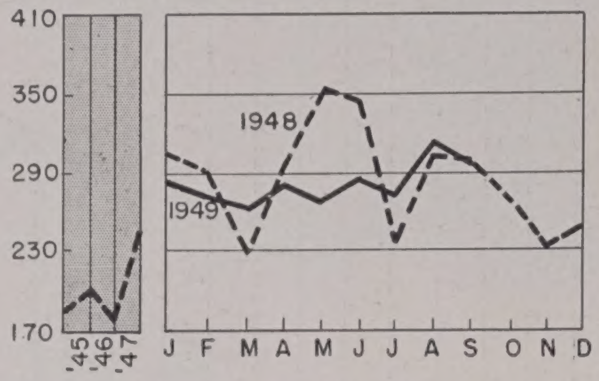
Flour Inches Higher



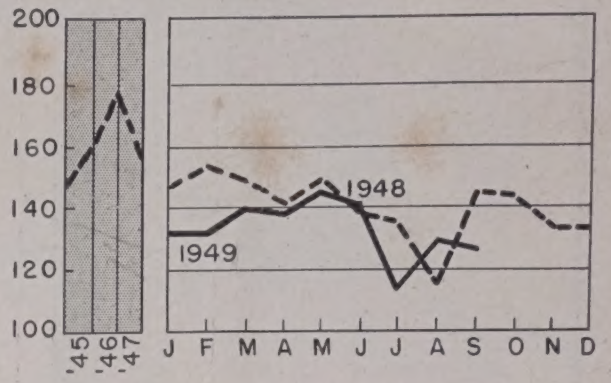
Butter Slopes Off



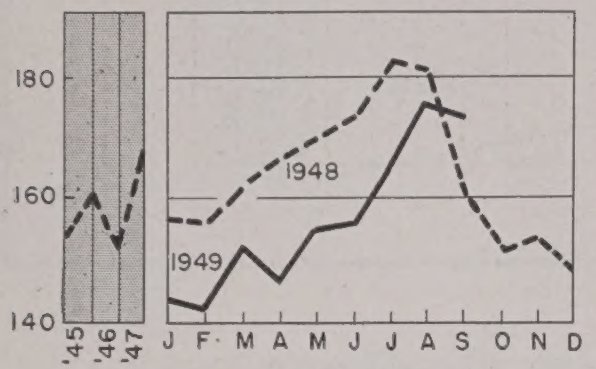
Margarine Falls



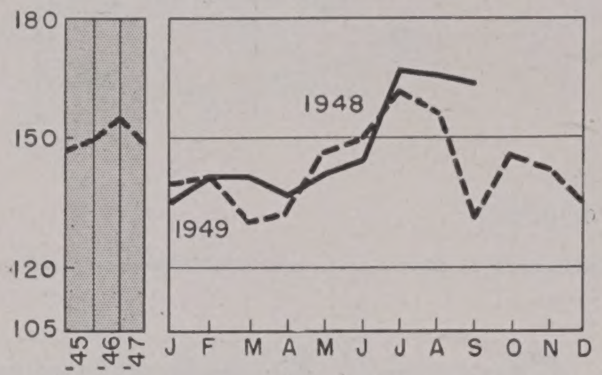
Canning Dips Again



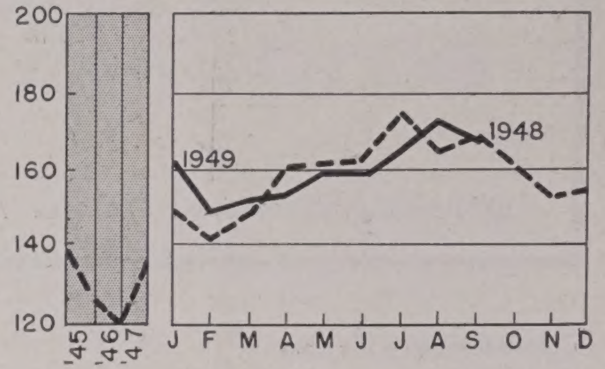
Malt Liquors Slide



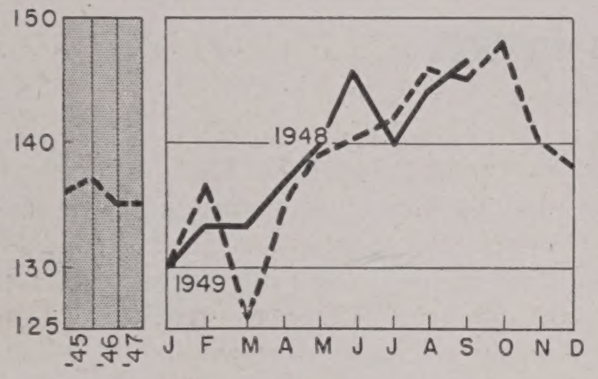
Cereals Descending



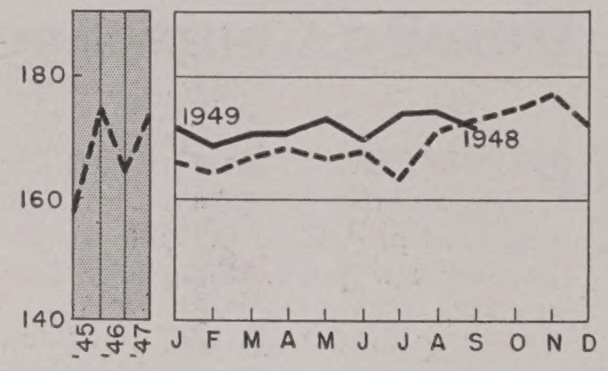
Beverages Turn Down



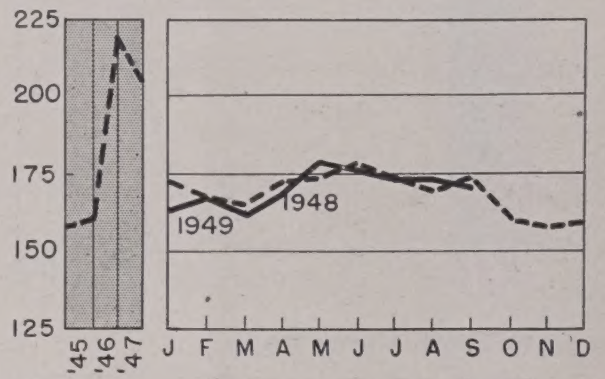
Baking Holds Gains



Condensed Milk Drops



Ice Cream Skidding



risen from 146.4 lb. per capita in 1948 to 147 lb. in 1949. In 1950, the Department of Agriculture predicts that per capita consumption may reach 150 lb. That would be well above the prewar average of 134 lb. but below the 155 lb. recorded in 1947. Evidently, getting consumption back up to that level depends on continuing the downtrend in prices.

On the other hand, consumption of dairy products has declined recently and may dip slightly more in 1950. Prices of fluid milk, cream and ice cream have been relatively high. Butter consumption has risen after substantial price cuts, but the price of butter is still higher than in the past by comparison with margarine. Processors are somewhat restricted in any effort to reduce prices of dairy products by the fact that their raw materials costs are pegged. Milk and butterfat are already at levels where the price is being actively supported by government purchases. Moreover, the farm price support level for these products has just been raised by the new support law enacted by the last Congress.

The convenience factor works in favor of many foods, even if these foods command a premium price. Increasing consumption of frozen products, particularly frozen fruit juices, illustrates this point. Probably at some future date price reductions will be necessary to broaden the market for these items. But there is still no indication that the present market is near saturation.

Household consumption of flour products has risen, as noted in the increased sale of prepared bread and cake mixes. By eliminating much of the work of home baking, these preparations have gained widespread acceptance. But they have cut into consumption of bakery products.

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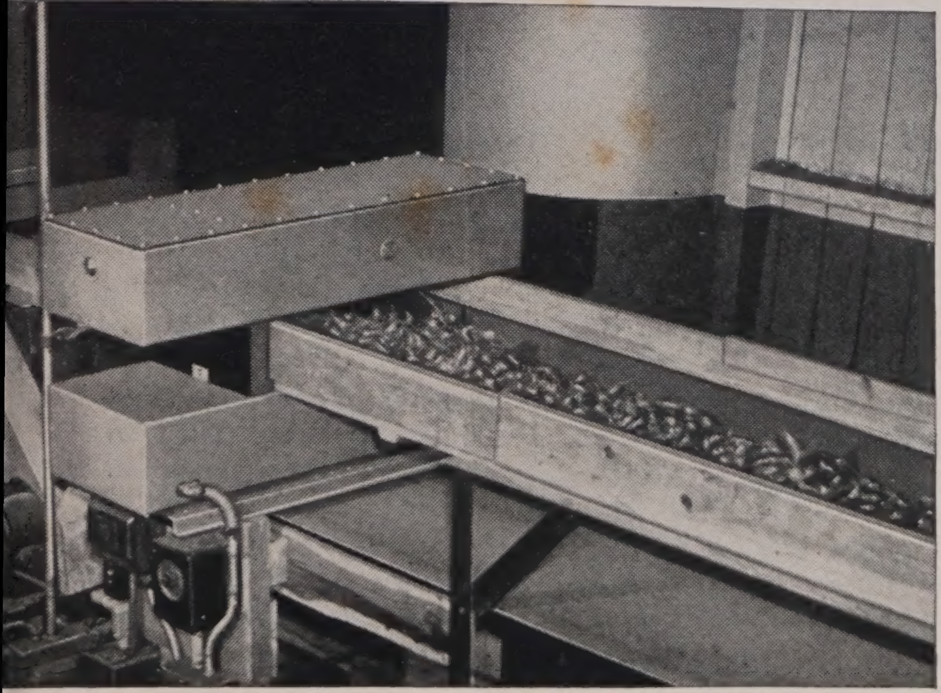
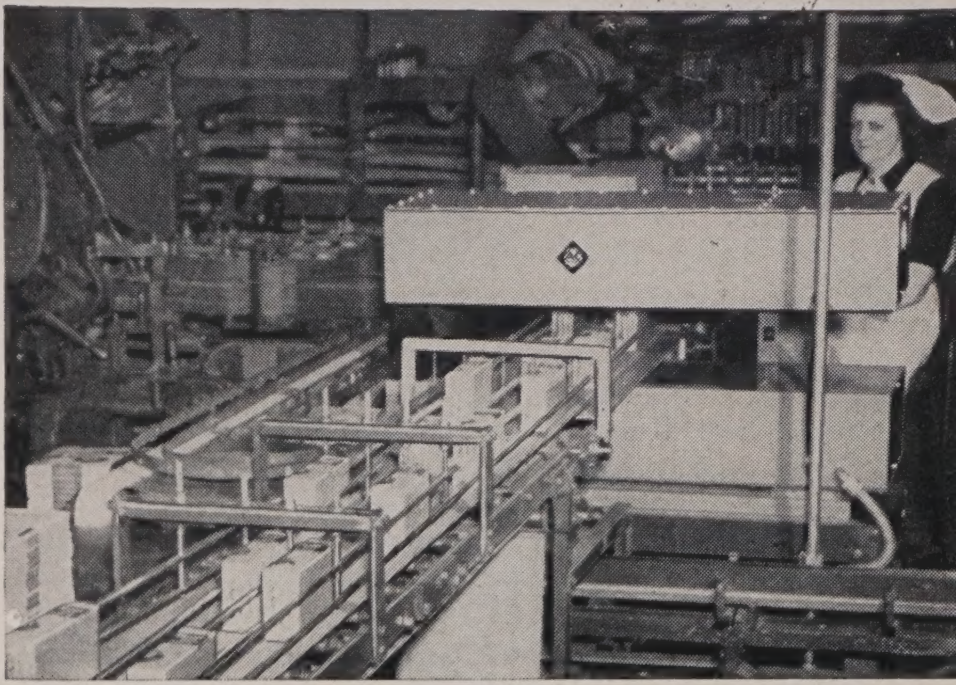
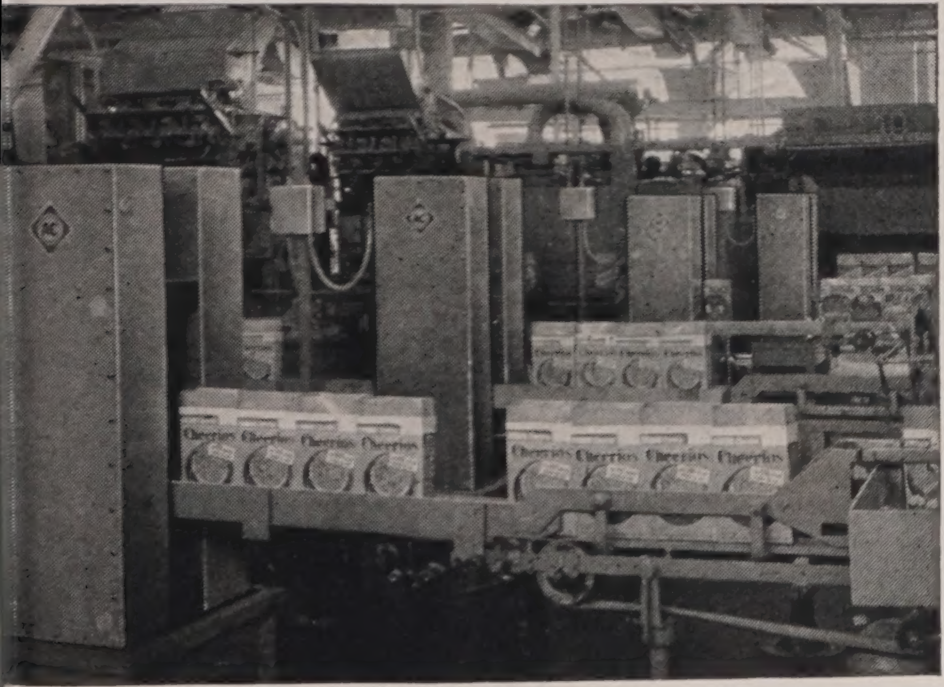
TRUE STORIES from Files of our Metal Detector Users



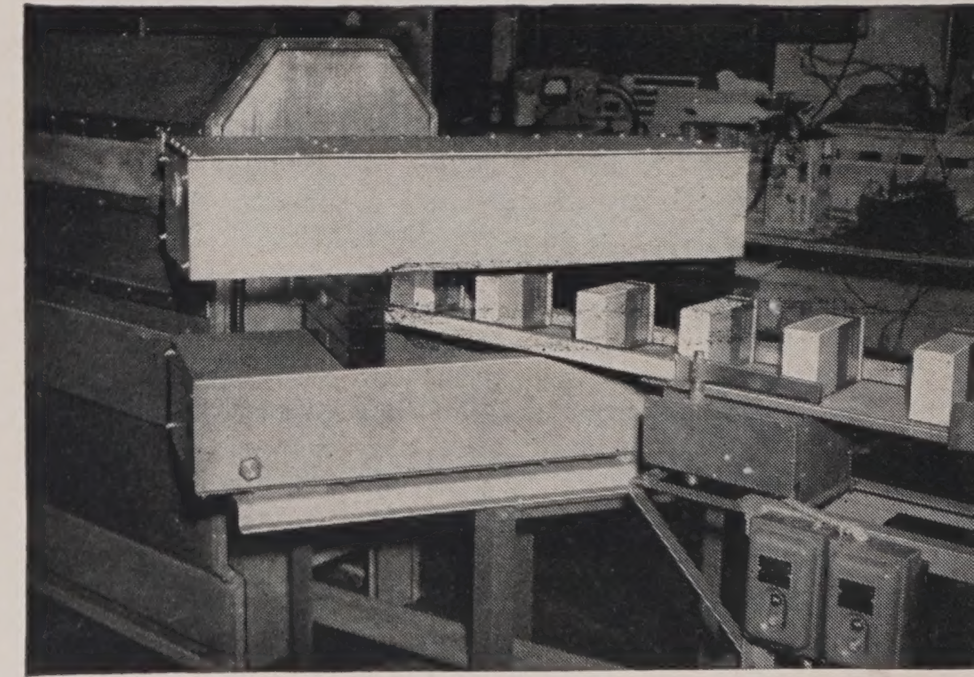
PAID FOR ITSELF — The first month the Electronic Metal Detector was installed in the plant of a cigarette manufacturer, the unit paid for itself by preventing damage to cutter knives. This is typical of prepackaging inspection of fruits, vegetables, and meats to be packed in metal or foil containers.



SAVED THE DAY — Candy maker started up his new Electronic Metal Detector and found it indicated metal in every package. He thought it must be the detector and called a serviceman. Discovered instead that rust scale from overhead pipes had contaminated the entire batch of candy during mixing. Typical candy plant installation shown.



PREVENTS CONTAMINATION — Large flour mill inspects 100-lb. bags of flour in a super sensitive 12 in. aperture type Metal Detector set vertically. Biggest trouble they found is with small pieces of metal from grain processing equipment that gets into the flour. Typical installation of Metal Detectors in vertical position shown.



DETECTS METAL SMALL AS .039 IN. — The consumer is protected by food packagers employing the Electronic Metal Detector, as shown, on packaging and canning lines. Your problem may be as unusual as the manufacturer of meat products who found stray B-B shot from hunters was a problem, and solved it with a Metal Detector.

PREVENT COSTLY SHUTDOWNS WITH ALLIS-CHALMERS ELECTRONIC METAL DETECTOR

MAGNETIC OR NON-MAGNETIC METAL PARTICLES are detected. Pieces as small as .039 inch are spotted no matter how deeply buried. Systems may be arranged so that when metal is detected: 1. conveyor is stopped, 2. automatic rejection device is actuated, or 3. an alarm signals for manual removal of contaminated article. Handles belts to 24″ wide at speeds from 15 to 600 fpm. Aperture heights: 2″, 4″, 7″, and 12″.

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The Talk of the Industry

Medical Cure for World Food Shortage

In this country we usually think of good health as resulting from good eating. But the World Health Organization and the Food & Agriculture Organization of the United Nations now find it necessary to turn this concept around.

Many undeveloped areas are short of food because of the poor health of the people. So the idea is to increase food production by medical measures which will get rid of widespread diseases such as malaria. Once the people are well enough to work hard, they can grow enough food to make them still stronger.

As this double-barrelled attack gets under way, the cumulative results in economic and social progress will be felt around the world. And the ranks of the democracies will be strengthened as the weakness and unhappiness upon which Communism thrives are replaced by vitality and more pleasant living.

It will take a little time, so success depends upon the cold war's staying cold. Pick your own odds.

Cheap Pounds and Expensive Coffee

This country's coffee habit has been getting steadily more expensive as the world shortage ups price. Some foresee housewives paying as much as $1 a pound for the product. But the outlook has been altered somewhat by an unexpected development growing out of currency devaluation.

When Britain reduced the pound from $4.03 to $2.80, the price of coffee in Europe increased accordingly. As a result, Europeans are expected to cut coffee consumption to the extent that an extra 1,500,000 to 2,000,000 bags will be available for purchase in this market. Britain, for example, will drink 20 percent less coffee next year because of its new austerity program.

During the last war, a prominent Frenchman suggested that we send our prime meat to France because his countrymen enjoyed good food much more than did Americans. Following this "logic," perhaps the British won't mind if we drink their coffee.

Palletizing Improves Quality

It is well known that handling food containers on pallets usually saves a lot of man-hours. But there sometimes is a good effect on quality, too. Proof of this is a recent report from Washington State. It conclusively shows that there was only one-fifth as much bruising of apples in boxes when moved on pallets instead of separately. So quality teams with cost to encourage modern handling methods.

Labor Skims Cream Off Milk Business

Sometimes you can't win. Take, for instance, the situation of the larger fluid milk companies in New York. They recently reduced milk prices 1 to 2½c. a quart under pressure from a city investigator who unjustly charged them with monopolistic profiteering. Then the International Brotherhood of Teamsters hit the dairies for a $10 weekly wage increase, plus company-financed pension and welfare plans—to be paid for by respective levies of 10 and 5 percent on payrolls.

But the payoff came when 15 smaller dairy firms broke away from the industry's wage negotiating committee and denounced the price cuts of the big dairies as a monopolistic scheme to undermine the other dealers.

Apparently the "independents" can't pay higher wages and meet the lower prices. But neither can the large companies—and make a profit.

Another example of business being put into an impossible situation by organized labor.

Bread Should Be Kept Out of the Cold

Bread—like bananas—apparently should not be kept in the refrigerator. The bakers haven't yet written a song about it, but current research on bread staling, by the American Institute of Baking, indicates that bread deteriorates faster when cold than when at room temperature.

This has more significance than is obvious at first thought. It may mean that bread ought to be hauled in insulated trucks in winter to give maximum protection to oven freshness. AIB has been studying that, too.

Another interesting angle on bread staling is that one can refresh a loaf by squeezing it. Seems that agitation reverses retrogradation of starch molecules. Could it be that the squeezing bread is given in the store by shopping housewives is good for it?

Hors d'Oeuvres

■ As though the dairy people weren't having enough trouble, they now learn that U. of Vermont scientists prefer gum drops to cheese in mouse traps. Stuff sticks to mouse's teeth, thus diverting him while trap springs shut on his neck. For a millisecond or two, the mouse must be quite confused.

■ Succotash, peas and carrots, ham and eggs—poo! Mere cooking combinations! Out in the Pacific Northwest, they are now producing caulicab seed. Grows up to provide a thick layer of cabbage leaves with a cauliflower curled up inside. Think what a tomelon could do for the tomato juice industry.

■ "Horsehair Now Comes From Cows . . ." says a headline in the *Wall Street Journal*, ". . . With the Aid of Chemistry." Kinda suspected something, even before we read the second part.

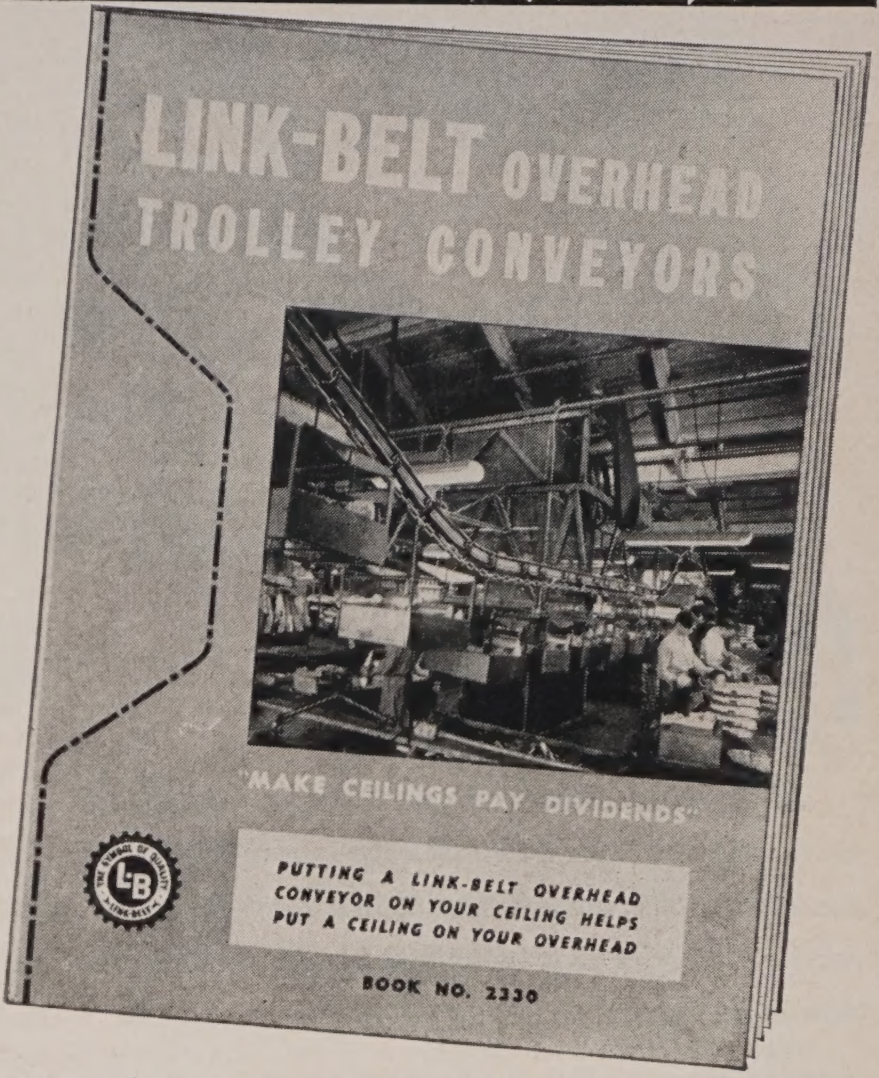
■ "Dear Sir: I like Phillips delicious because—Phillips means food, Phillips means good food, Phillips means very good food, and the fact that they are offering four Packards to consumers for the best letters completing this sentence has nothing to do with it—much."

■ After testing 134 different kinds of eggs, Cambridge U. scientists conclude that the output of the emu is the tastiest. And just after Uncle Sam gets such a nice batch of chicken eggs stacked away.

■ Once a year, our staff points a finger at us and orders: "Say something worthwhile." But that's just because they insist on poking in here to join in wishing you and everyone a Merry Christmas.

J.A.J.J.

LINK-BELT *overhead trolley conveyors*
For Efficiency and Versatility in Materials Handling



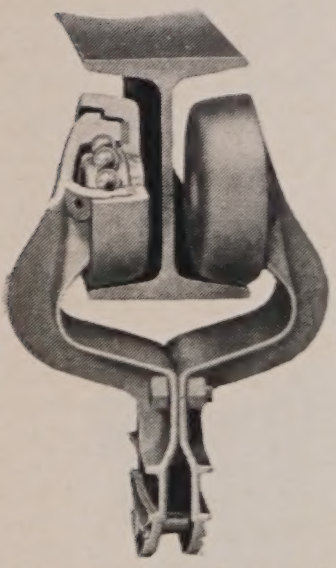
LINK-BELT OVERHEAD TROLLEY CONVEYORS

"MAKE CEILINGS PAY DIVIDENDS"

PUTTING A LINK-BELT OVERHEAD CONVEYOR ON YOUR CEILING HELPS PUT A CEILING ON YOUR OVERHEAD

BOOK NO. 2330

Many conveying jobs in manufacturing plants can be handled efficiently by flexible, economical Link-Belt overhead trolley conveyors. Saving valuable floor space by using ceilings, moving at pre-determined speeds, overhead conveyors coordinate various operations for assembly line work. Materials weighing a few ounces or many tons, varying in size from several inches to many square feet—products as fragile as eggs or as bulky as freezers—are conveyed gently, easily, without breakage or damage.



Link-Belt overhead conveyor trolleys are the last word in rugged strength, simplicity, smooth operation. Note the construction, with drop forged steel wheels and brackets and a full complement of ball bearings operating in hardened steel races, assuring long life and trouble-free operation. Send for Folder No. 2241-B.

Widely adaptable, Link-Belt overhead conveyors do actual productive work, too, such as dipping, drying or freezing, meanwhile, providing exact timing. Unaffected by heat, cold, dust, or fumes, they relieve workmen of unpleasant tasks. They fit into any building, whatever the arrangement; travel long or short paths, straight or irregular; are easy to install; and cost little to maintain and operate.

Link-Belt makes practically all types of conveyors (see below) as well as a complete line of power transmission machinery. We suggest you discuss your problem with a Link-Belt engineer, who will offer practical advice. Get in touch with the Link-Belt office nearest you.

Write for your copy of the new Link-Belt Book No. 2330 on Overhead Conveyors

This new book shows how Link-Belt overhead conveyors have solved many conveying problems economically in different types of plants. It illustrates, with on-the-scene photographs, how Link-Belt conveyors save floor space, release manpower for productive labor, coordinate various operations. Write for it!

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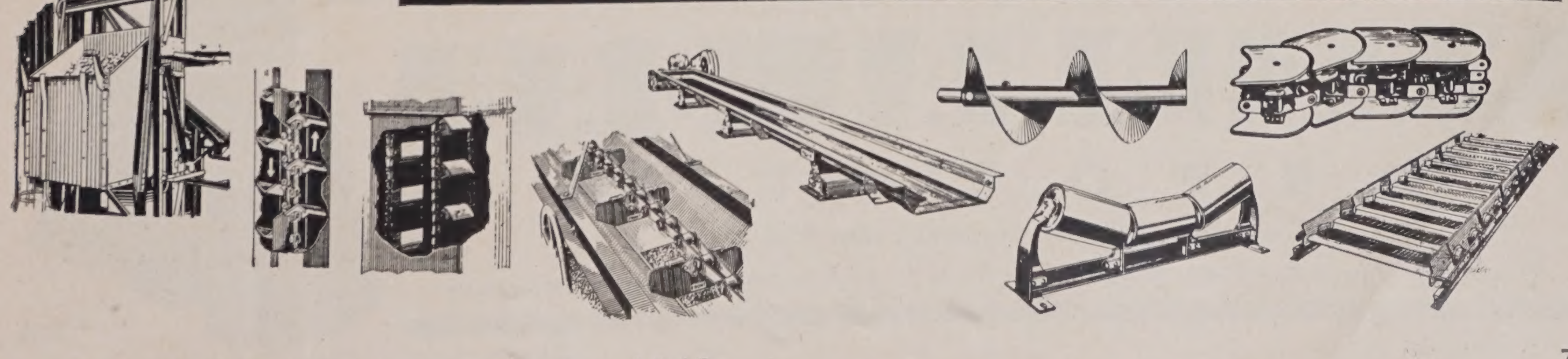
LINK-BELT MAKES MANY TYPES OF CONVEYORS...



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What Washington Thinks

POTATO CHIP QUALITY — Three characteristics of potatoes have been investigated to determine their relative merit for potato chip making. A potato is best if it provides a maximum yield, a light golden brown color of chip, and a minimum of oil absorption. Recent studies in the Department of Agriculture using these criteria make it clear what varieties of potatoes the chip maker should buy for economical and quality production. Complimented are Russet Burbank, Russet Rural, and Sebago.

NONFOOD BYPRODUCTS—Surplus skim milk, buttermilk, and whey continue to be a problem of the dairy industry. Recently, government investigators have particularly emphasized new food products based on these surplus dairy items. But still more important for the benefit of the milk products business would be their increased use in non-food applications, such as casein for coated paper, glue, and water paints. Another smaller use is application of milk sugar as mold food in penicillin manufacture.

INCREASED FREIGHT—Rises in freight rates authorized by Interstate Commerce Commission during the last three years have appeared to be uniform for most classes of raw material and manufactured products. Actually, there is an important difference between some commodities and others, as well as between some areas and others.

Food executives will note with comfort the fact that food raw materials, like fruits and vegetables, have borne the smallest increases, generally between 42 and 45 percent, as compared with 1946 mid-years. The increases on animal products have been much higher —between 60 and 63 percent—though live stock bore an intermediate rate of increase, about 54 percent on the average. Finished foodstuffs like vegetable oils, sugar, packaged groceries, and similar products, are in the high freight-increase class.

It would be fine if food manufacturers could explain to all housewives how these changes in transportation cost are going to show up in market-basket prices. Perhaps a bit of publicity along that line would be worthwhile—for the contribution to the cost of living is very substantial.

ESSENCE IS TAX FREE—Congress has recently instructed the Bureau of Internal Revenue not to collect a tax of $9 per gallon on fruit essences. Formerly, this burdensome excise levy made uneconomical the use of the fruit essences in many types of fruit-flavored foods. The new act promises, Department of Agriculture executives believe, that consumers should soon be getting food products with finer fruit flavors.

DOUBLE DECLARATION—The National Conference on Weights and Measures at its last meeting in Washington again considered seriously the proposal that each package of frozen food provide a declaration of the amount of solid and the amount of frozen liquids as *separate* items. This effort of interested state and local officials is not likely to be mandatory generally; but it is quite possible that statewide requirements of this kind will be adopted. It's a matter that needs to be watched.

STANDARDIZATION — There continues to be considerable demand among local officials and by certain women's organizations for the standardization of food package sizes. The idea is that any particular commodity should always be in 2, 4, or 8 oz. packages, or in some even multiple of a pound. The present common food practice of choosing a desirable container size and then labeling the resulting content is criticized on the ground that it deceives the housewife purchaser. Recently, the idea of "package standardization" in this manner secured a strong endorsement in principle by the pertinent committee of National Conference on Weights & Measures.

WATERED STOCK—A careful investigation by the Missouri Agricultural Experiment Station convincingly shows that a cow should have a plentiful supply of cool water, especially in warm weather. One beneficial result is an increased production of milk. This method of watering the milk is legal, of course. One wonders whether the required four pounds of water per pound of milk results in any change in the water content of the lacteal fluid. Perhaps efficiency in milk production by the water route ought to be of concern to Food & Drug Administration.

MORE PROCESSING — Substantial growth in the proportion of fruit and vegetable crops that are processed is reported by recent statistical studies of Farm Credit Administration. Incidentally, cooperatives are doing an increased share of this business in most instances. Co-ops doubled their pack of frozen fruit between 1945 and 1948. They made a 12 percent gain in canning activity on fruits, but only a 4 percent gain in canned vegetables. Their citrus pack was up by 28 percent between 1947 and 1948. The only activity of co-ops that declined was frozen vegetables, which decreased by a mere 2 percent. Co-ops are thus an outstanding factor in the whole processing business.

OFFICIALS NAMED—Public Health Service has named a chief for each of those regional offices dealing with questions of stream pollution. Probably most important to food technologists is the appointment of Louis F. Warrick as engineer in Washington in charge of the extensive water-pollution control research program. Cooperation with all technical service branches, and with the research group in Washington, will be encouraged by the Service. But when local regulatory and survey questions are involved, most effective means of cooperation will probably be found in the regional offices.

It is going to be necessary for many of us in food technology to become well acquainted with BOTH Washington and regional officials.

LAW MAKING—The 1949 activities of Congress resulted in much more legislation than seemed at all probable early in the year. On adjournment, the legislators went home amid a shower of bouquets and brickbats, the character of the comment varying largely with the social sentiments of the observers. Two important generalizations seem justified: First, Congress dealt vigorously with international problems and has left all idea of isolationism in the ash can. Second, much more emphasis on Federal control of many activities has been established, or seems likely to mature next year before the present Congress ends. This latter tendency accounts for the frequent charges of a "movement toward statism."

EMULSIFIERS — In promulgating tentative standards of identity for salad dressing, F&DA finds no evidence on which to justify specific designation of those emulsifiers that are encompassed in the general descriptions of suitable optional ingredients. Is this a bread standard preview?

—**R. S. McBride, Washington, D. C.**

HIGHLIGHTS

Congress again indicates that any reduction in farm supports—even for surplus commodities—is a forlorn hope. Selection of a "permanent" bill seems to rest between the old 90 percent supports for "basic" products and 100 percent for most commodities. In either case, the farmer is in for a lot of political control. (See News section)

Unique non-stick property of Teflon plastic is leading to its use in food machinery, such as dough rounders. It is being considered also for confectionery equipment parts and molds. Teflon is quite strong, resists abrasion, withstands high temperatures, and is rarely affected by any chemicals. It can be molded to shape or sprayed on, and is excellent gasket material. It may be the answer to many "sticky" problems.

What to do with citrus pulp has become a problem in the skyrocketing frozen concentrated juice industry. And Minute Maid has come up with an answer. Water and citrus oils are removed from the pulp without hydrolysis of the protopectin, then the dried and ground product is used as plastic filler. The protopectin reacts in polymerization to chemically bond the filler to the resin, giving a hard, tough plastic. Again, byproduct development pays off.

Dairy prices in general will be slightly lower in 1950, according to USDA's outlook for the industry. It's a combination of a falling-off of exports and weakened domestic demand in the face of a milk supply as great or greater than this year. But processor stays in middle.

A recently developed semi-continuous method of alkali-rendering and refining of lard now bids to compete with the older steam, open kettle and vacuum-rendering processes. Lard made by the new method is termed far superior to the steam-rendered product, and it may be competitive with other shorteners. Result may be a comeback for lard as the standard domestic and commercial shortener. (See article in this issue)

Half-baked rolls are an interesting innovation in the baking industry. These are ordinary rolls baked at 275 deg. F. until the starch is set. The housewife buys the white, underdone product, puts it in the oven for 7 to 10 minutes, and gets fresh, hot, nicely browned rolls. The underbaked "makings" will keep a week at room temperature, two weeks in a refrigerator, indefinitely when frozen. The idea originated with a small Southern baker, was picked up by General Mills and introduced in Chicago early in November. Time lost: None.

Removal of the $9-per-gallon tax on production and sale of alcohol-containing essences—which include most fruit essences—is hailed by manufacturers of ice cream, sherberts, carbonated beverages, candies, table syrups and gelled desserts. A cut in taxes of any kind is really big news today. (See News section)

An ingenious filter-paper technic for separating constituents of a complex substance, such as proteins, has just been introduced to cereal chemists in New York. Called chromatography, it involves placing a drop of the substance to be analyzed on the edge of filter paper. Constituents—such as amino acids—are absorbed on the paper at different points. Turning paper at right angles gives further separation in a 90-deg. direction. Spraying with a chemical colors the spots. Or ultraviolet can be used to make spots fluoresce. Area and density of spots are measured. Accuracy as high as 2 percent is reported possible. Method is said to be better than microbiological analysis for some work and to have wide food use.

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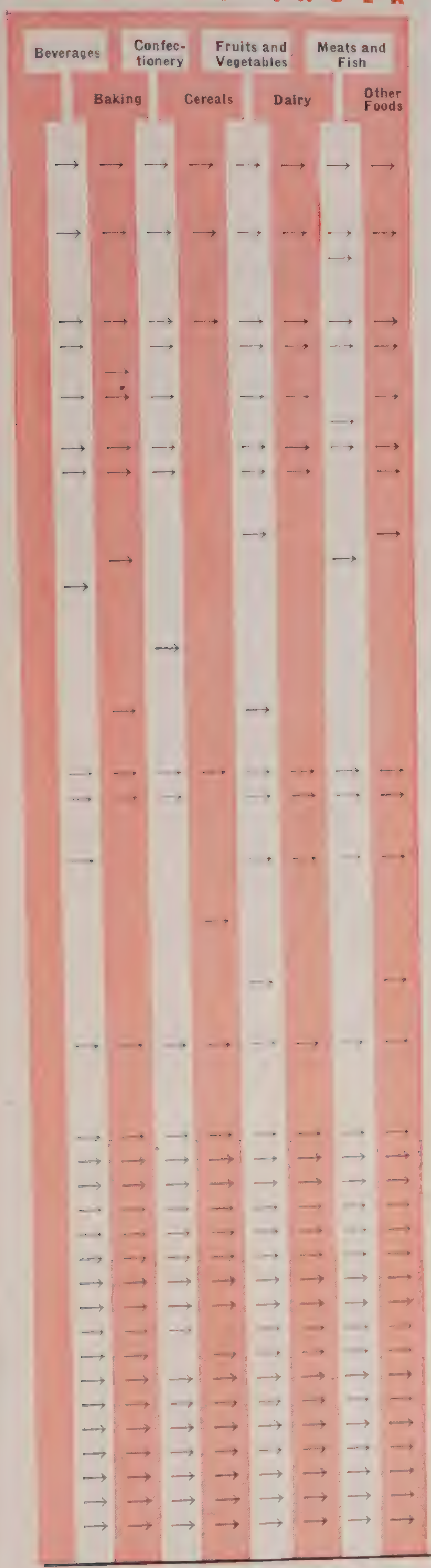

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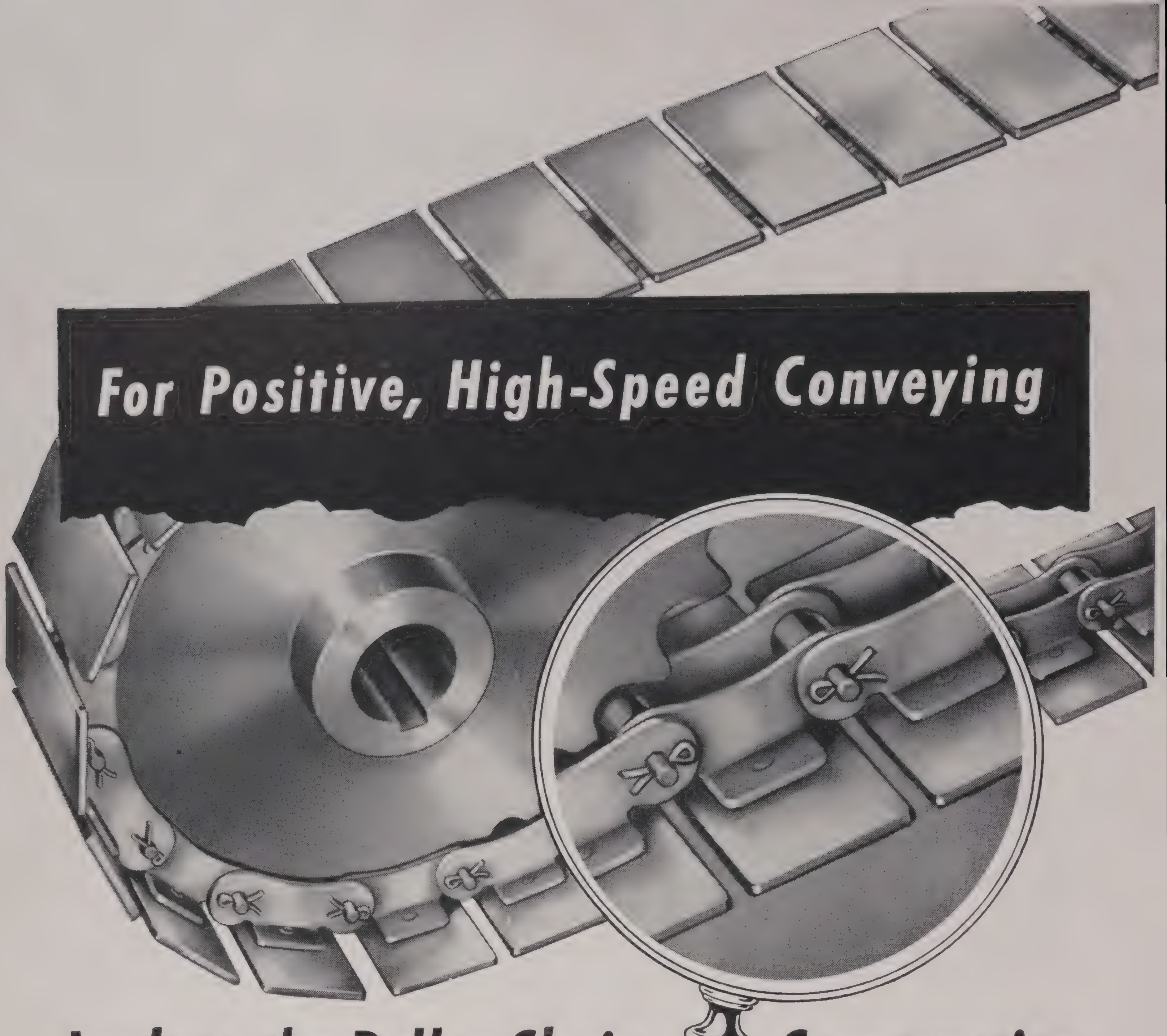

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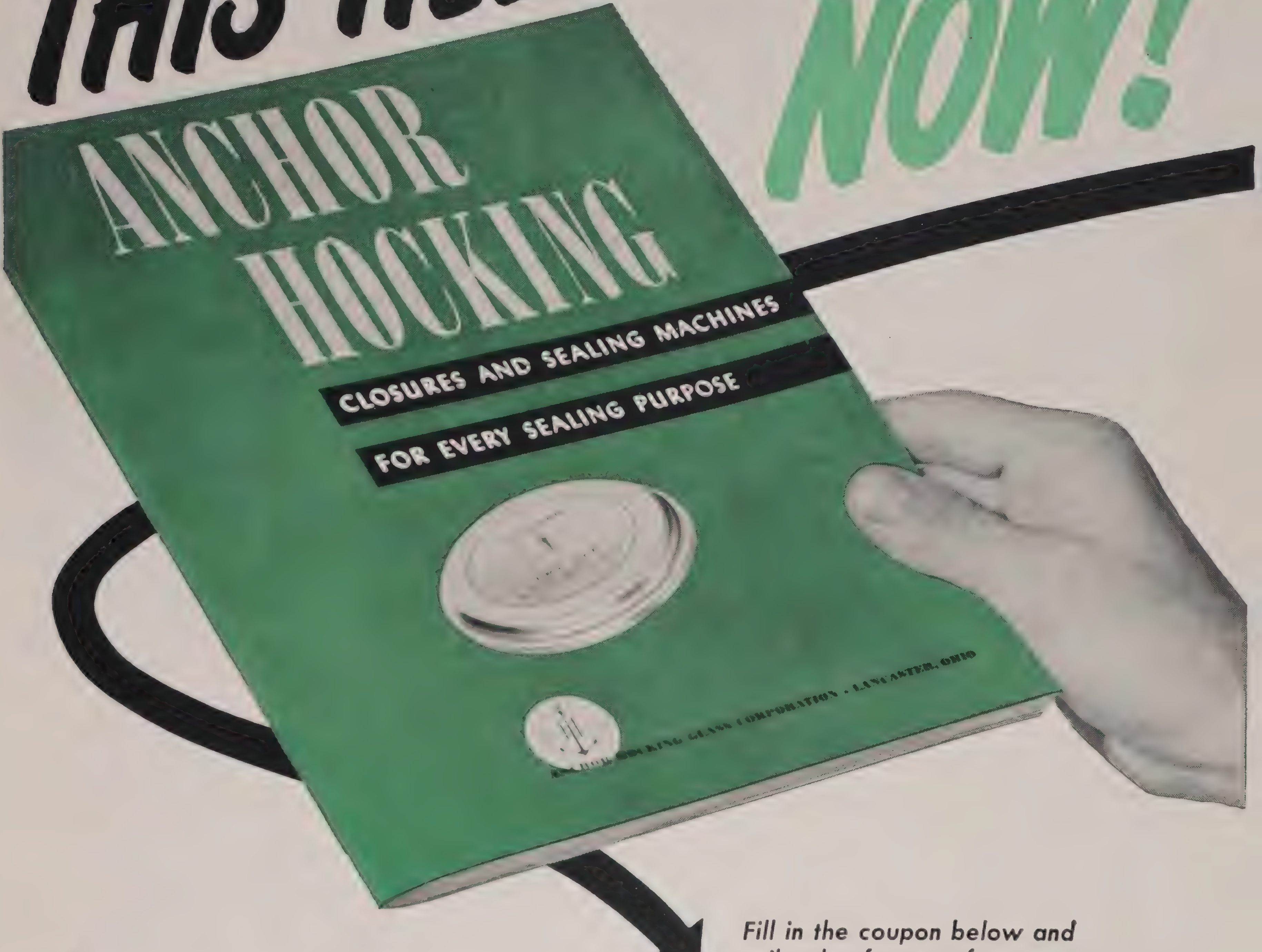
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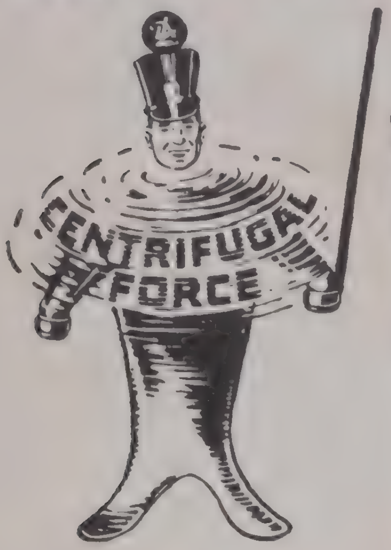

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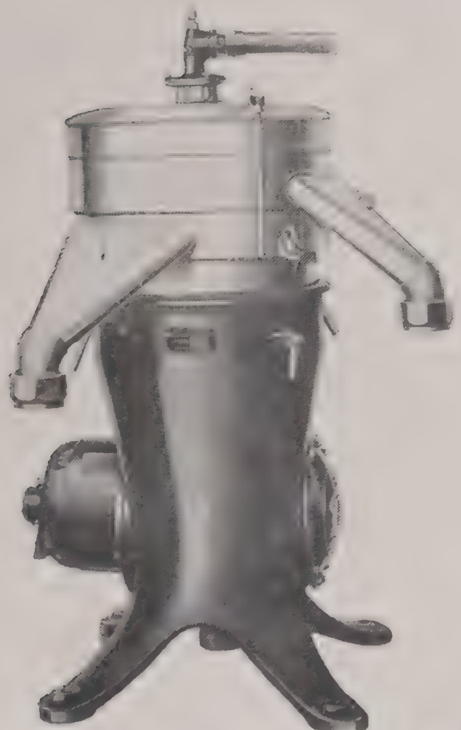

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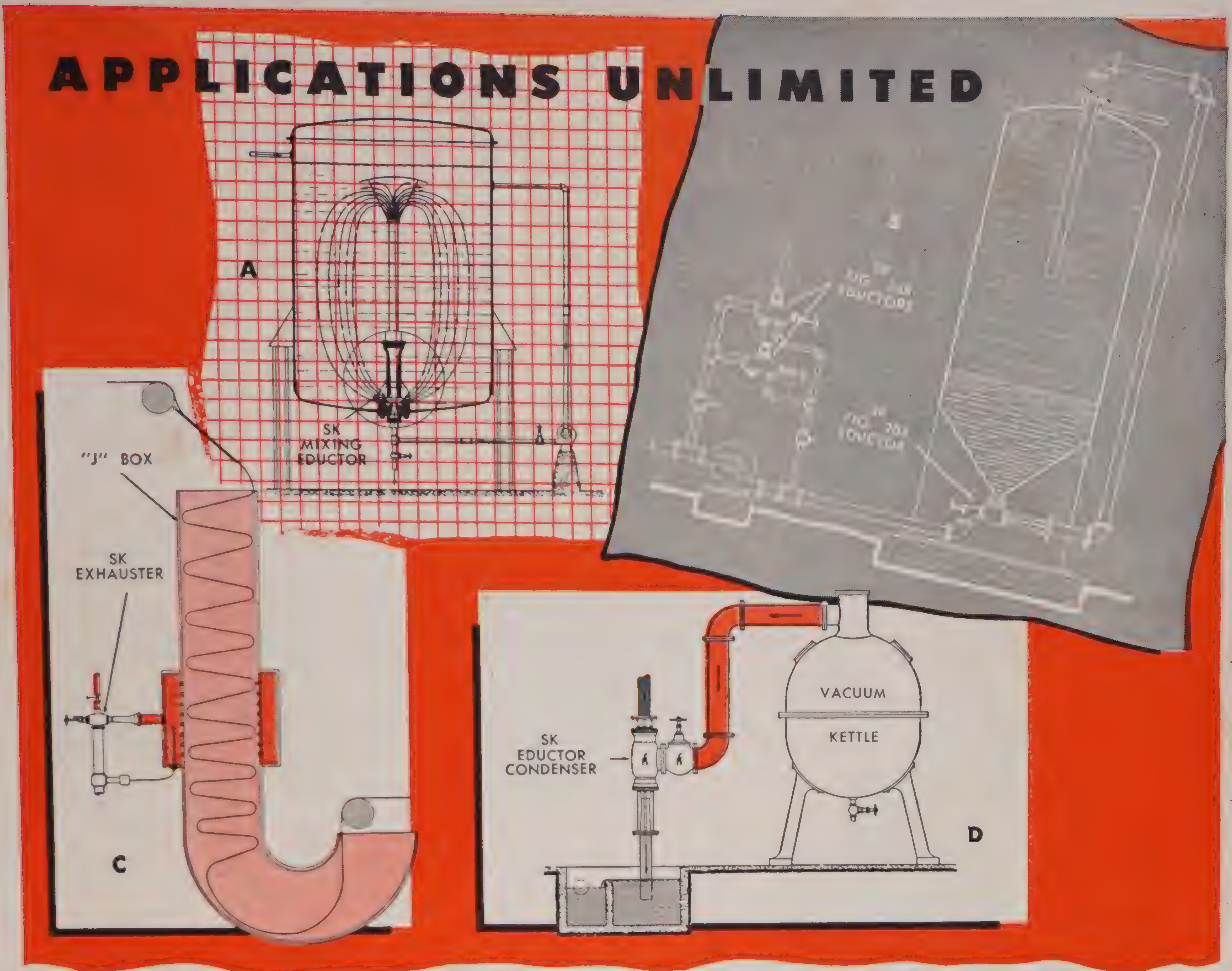

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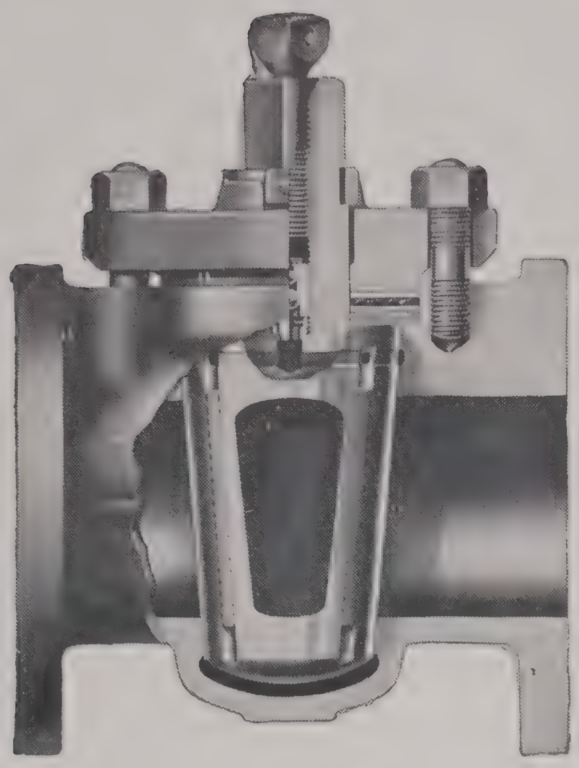

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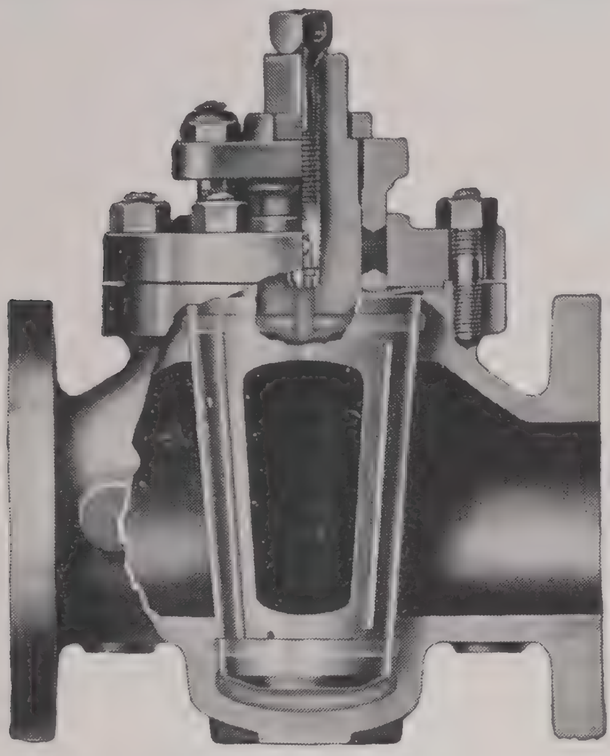

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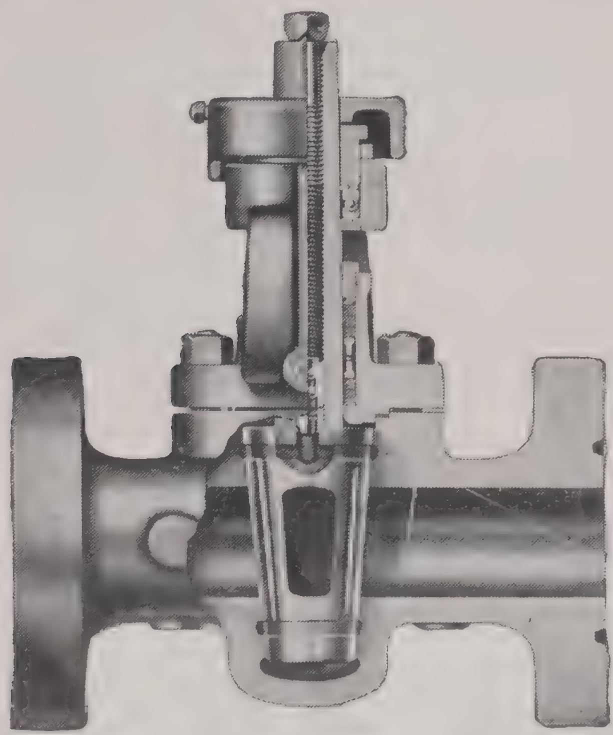

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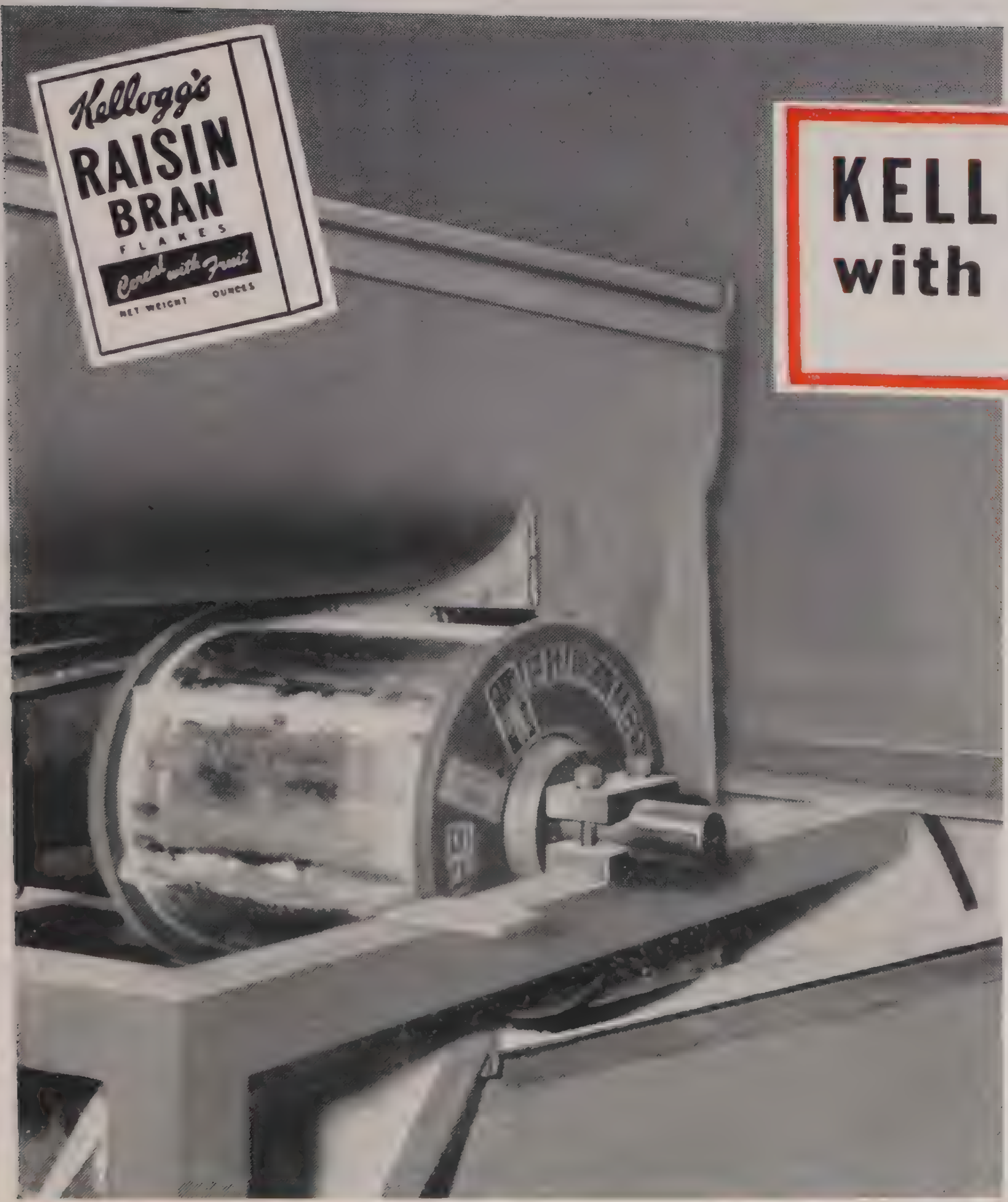

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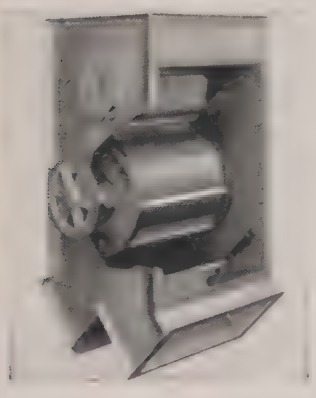

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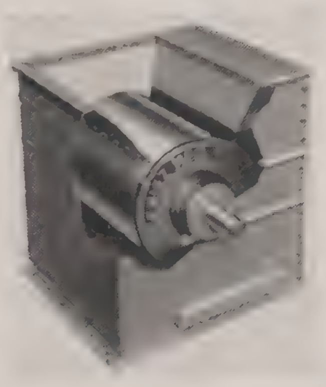

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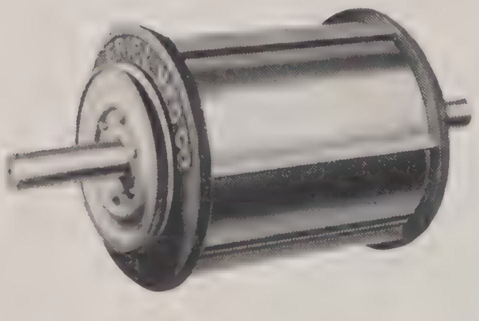

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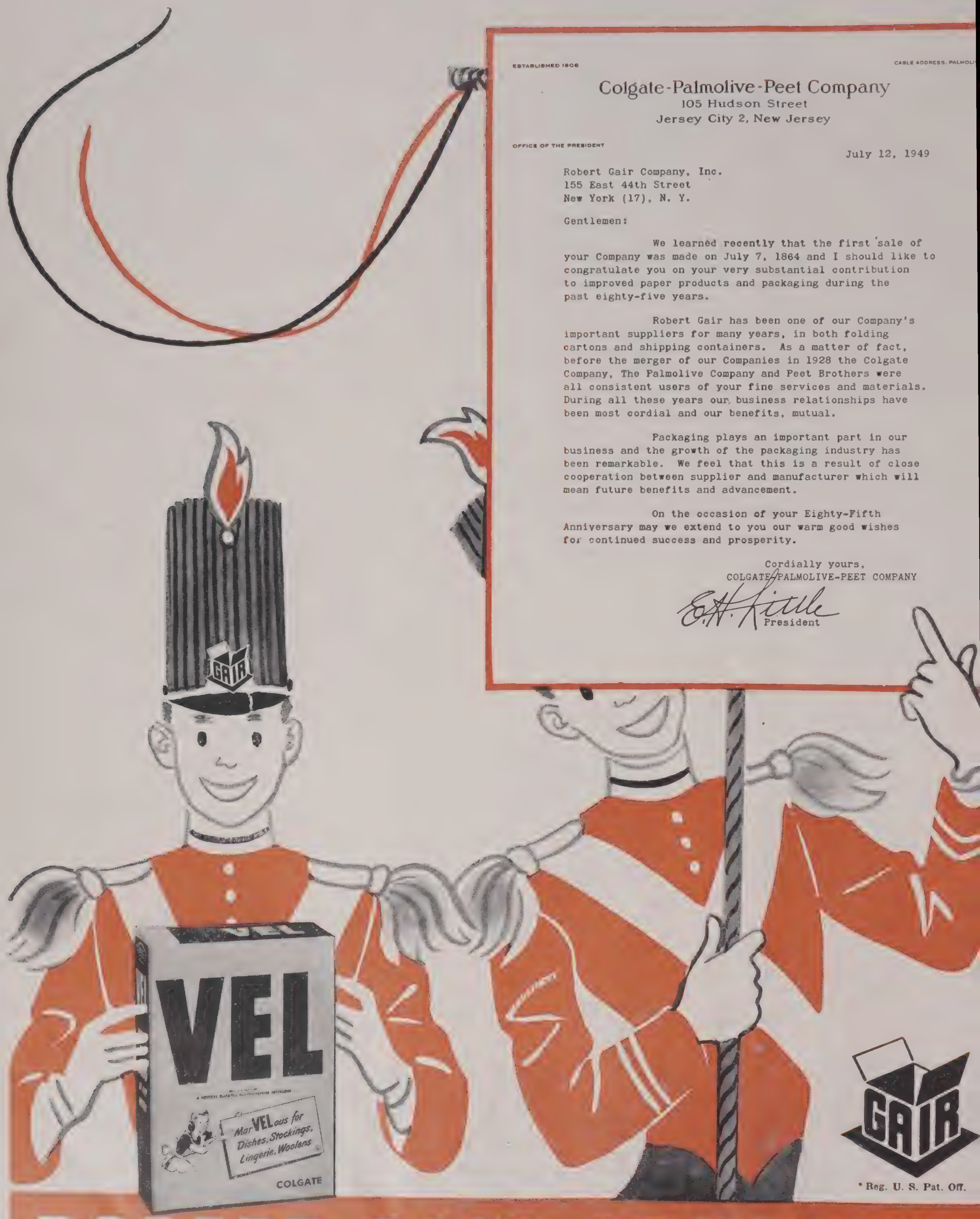
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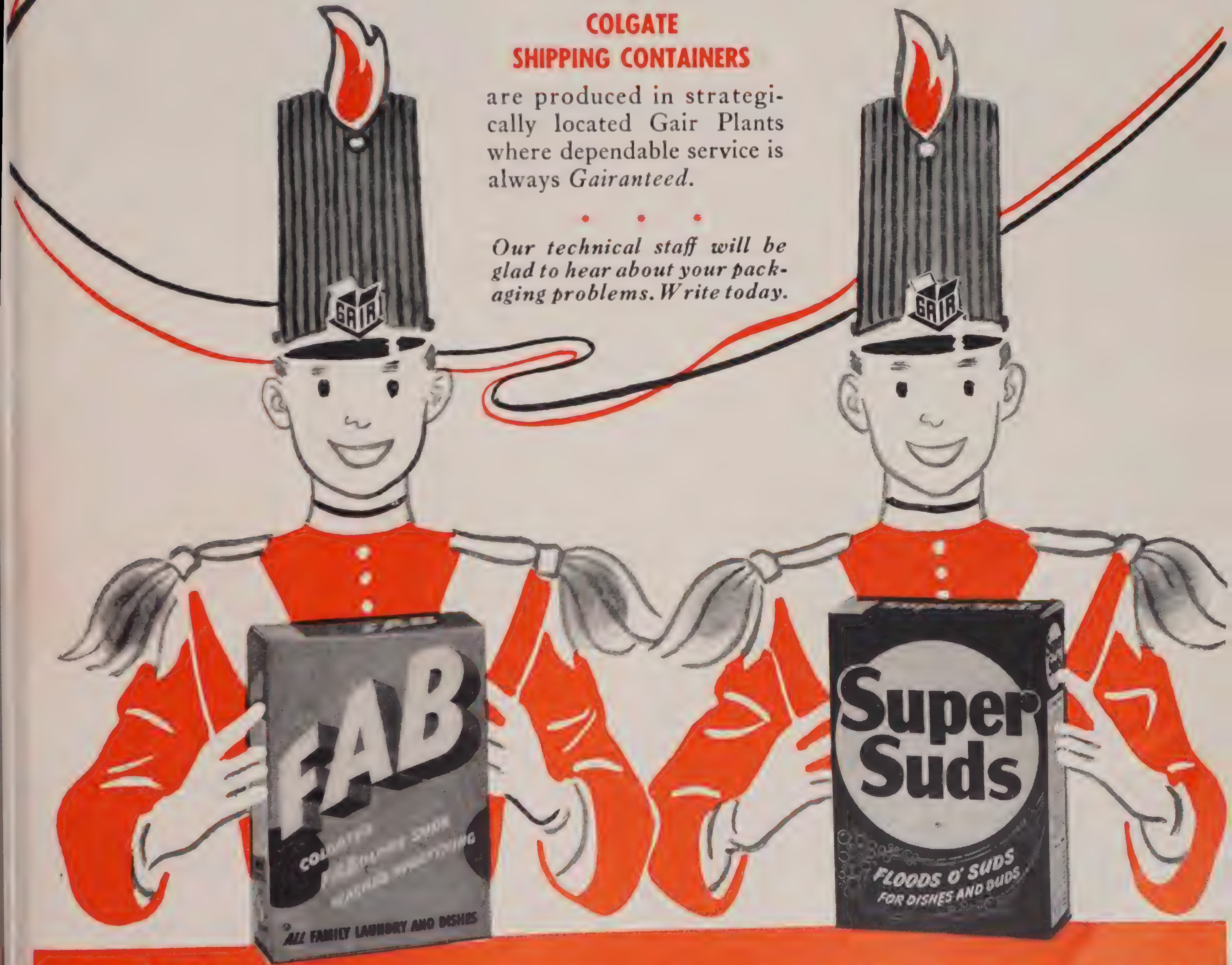

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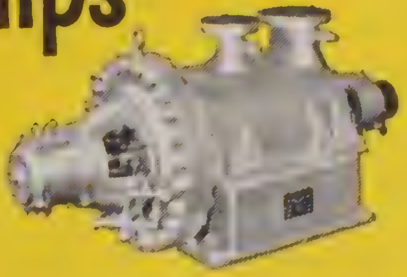
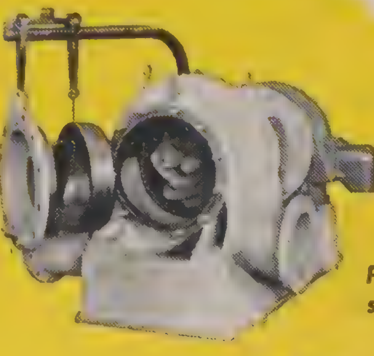
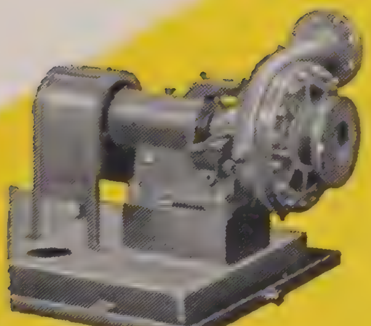


Extremely Hi-pressure Boiler Feed Pumps



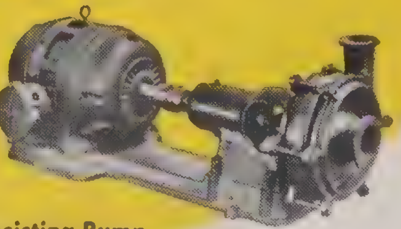
Pumps for heavy saline chemicals



Fluid Process Pump

Stainless steel milk pump

Beet sugar pump



Corrosiron Acid-Resisting Pump

POWDERS

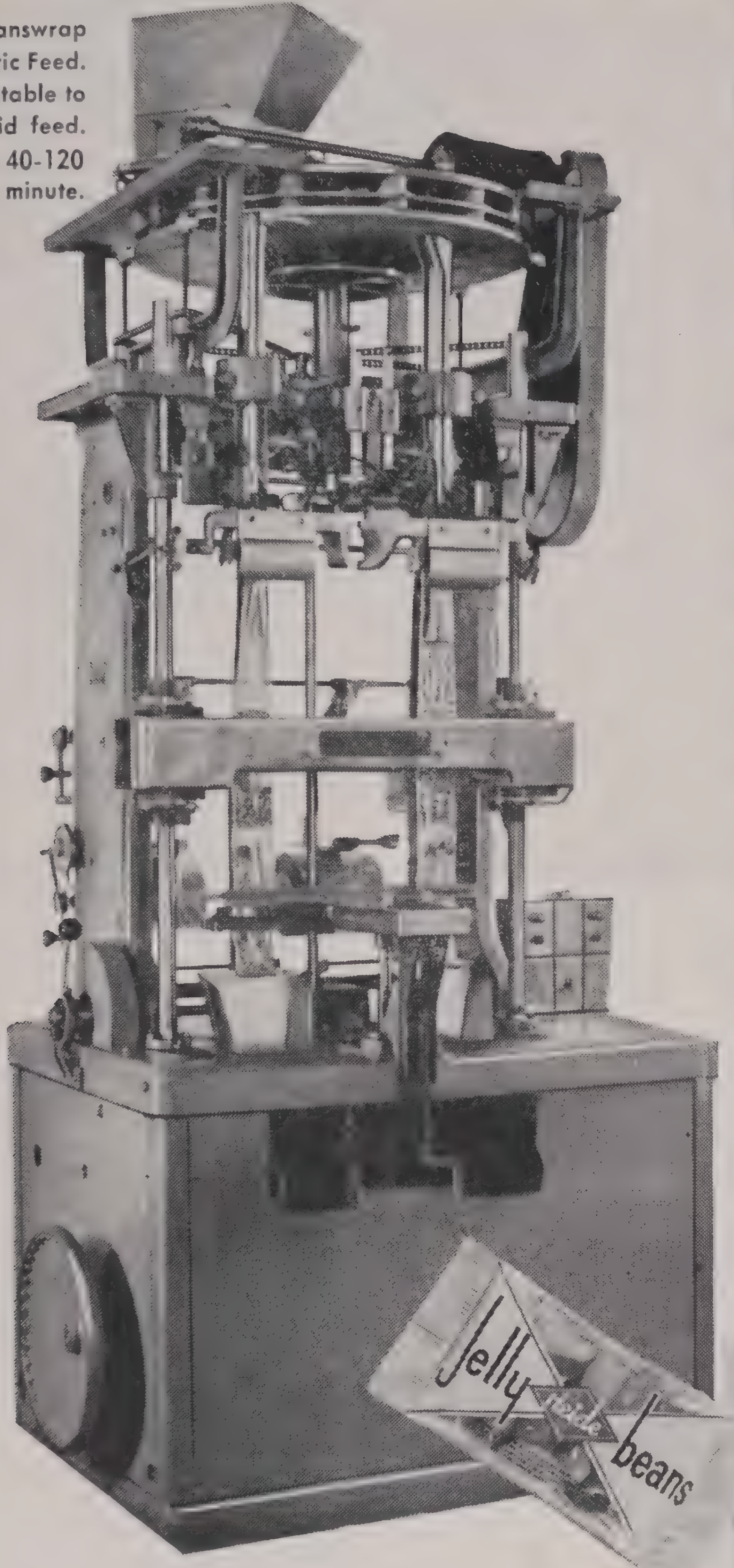
TABLETS

FREE FLOWING SOLIDS

LIQUIDS OR SEMI-LIQUIDS

TRANSWRAP

AUTOMATICALLY COMBINES MINIMUM PACKAGE COST WITH MAXIMUM VERSATILITY



Model "B" Transwrap with Volumetric Feed. Also adaptable to auger or liquid feed. Produces 40-120 pkgs. per minute.

In one machine, TRANSWRAP is a self-contained "packaging department." Using cellophane, Pliofilm, glassine, roll foil or other suitable heat-sealing materials, it forms, fills and seals your package completely automatically.

The same TRANSWRAP machine with suitable feed assembly can package 1 aspirin tablet or 1 lb. of peanuts . . . 1 teaspoon of vanilla extract or 1 lb. of margarine . . . 5 grams of salt or 16 oz. of powdered milk. Package sizes possible range from 7/8" x 2" to 5¼" x 13". They may be either pillow, or "fin seal" type (sealed around four edges).

From the standpoint of economy, TRANSWRAP adjustments and operation are so simple, a single operator can handle a whole battery of machines. Attractive, sales-conditioned TRANSWRAP packages, *filled and sealed*, actually *cost less* than ready-made *empty* bags.

Custom-engineered adaptations are possible on any TRANSWRAP machine to meet your individual requirements with maximum efficiency.

WRITE FOR FREE ILLUSTRATED BROCHURE

Jelly beans
Domeboro TABS Powder
DEODORANT DOUCHE POWDER
NESCAFÉ
NESCAFÉ

Manufactured and Sold by

TRANSPARENT WRAP MACHINE CORPORATION

Route 17 and Henry Street
Hasbrouck Heights, New Jersey

REPRESENTATIVES IN PRINCIPAL CITIES OF THE U. S.

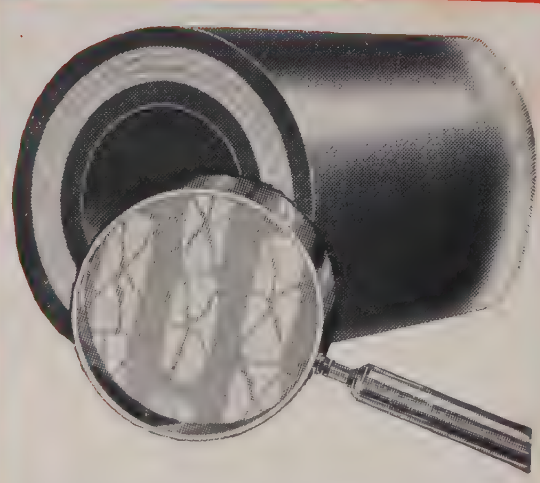
Specify Thermoid

Versicon Hose Cuts Costs

Now available . . . a multi-purpose hose designed for superior performance with virtually any liquid or gas . . . Thermoid Versicon Hose. It is made with neoprene tube and oil-resistant cover—with high tensile rayon cords to insure maximum strength, light-weight and flexibility.

Versicon, another of the famous quality rubber products made available to industry through Thermoid research, is the answer to a long felt need. Now your nearest Thermoid distributors can supply you with *one hose* for your requirements. Now you can cut your costs and reduce inventory. Versicon eliminates the need for special hose . . . Versicon *is* the special hose. Available from 3/16″ to 2½″ for use with air, water, oil, gases and virtually all fluids in lengths from 50′ to 500′ depending on size.

It will pay you to *Specify* Thermoid!



The Thermoid Impregnation Process insures a deeper penetration of rubber between the threads of the yarn, which encases each individual strand with protective rubber. The rubber acts as a sheath between the strands and prevents the destructive abrasive action as the product is flexed in use. To obtain the required rubber penetration, the twist of the yarn must be to exact specifications. With the yarn twisted too tightly, proper penetration of the rubber compound is impossible. This condition produces abrasion, causing premature failure. On the other hand, if the yarn is twisted too loosely, the product lacks tensile strength. Thermoid has discovered the optimum twist of the yarn which assures maximum rubber penetration and greatest strength. The development of Thermoid Impregnation Process is another step forward in Thermoid's planned program of product improvement, assuring maximum service and lower operating costs to industry through the use of Thermoid Industrial Rubber Products.

Thermoid Quality Products: Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

Thermoid Company

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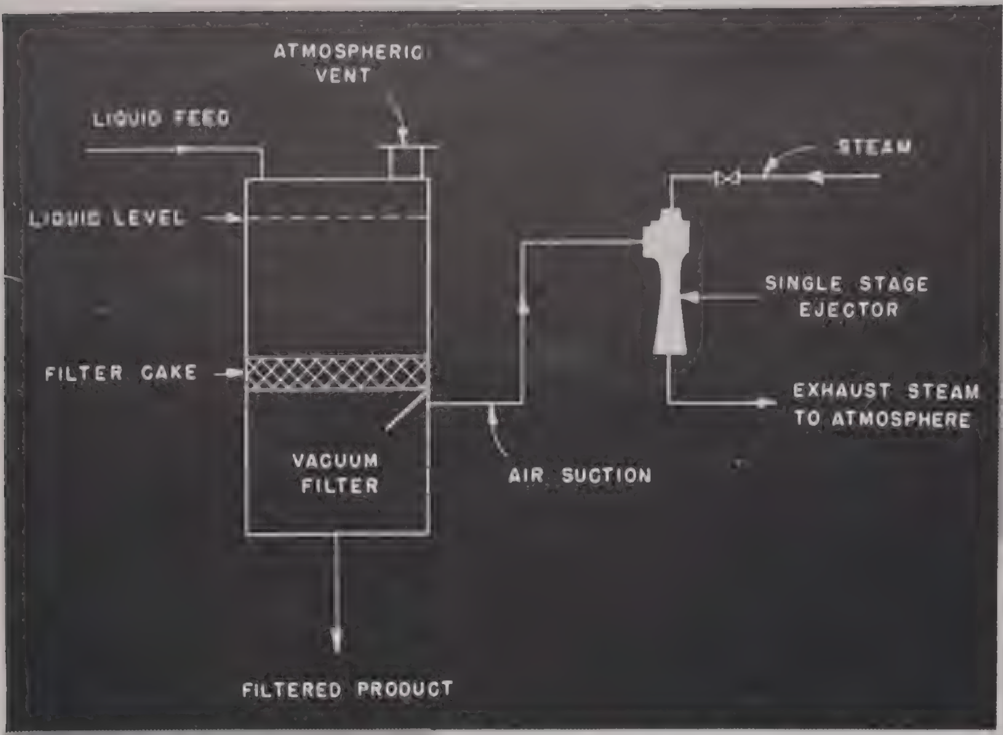
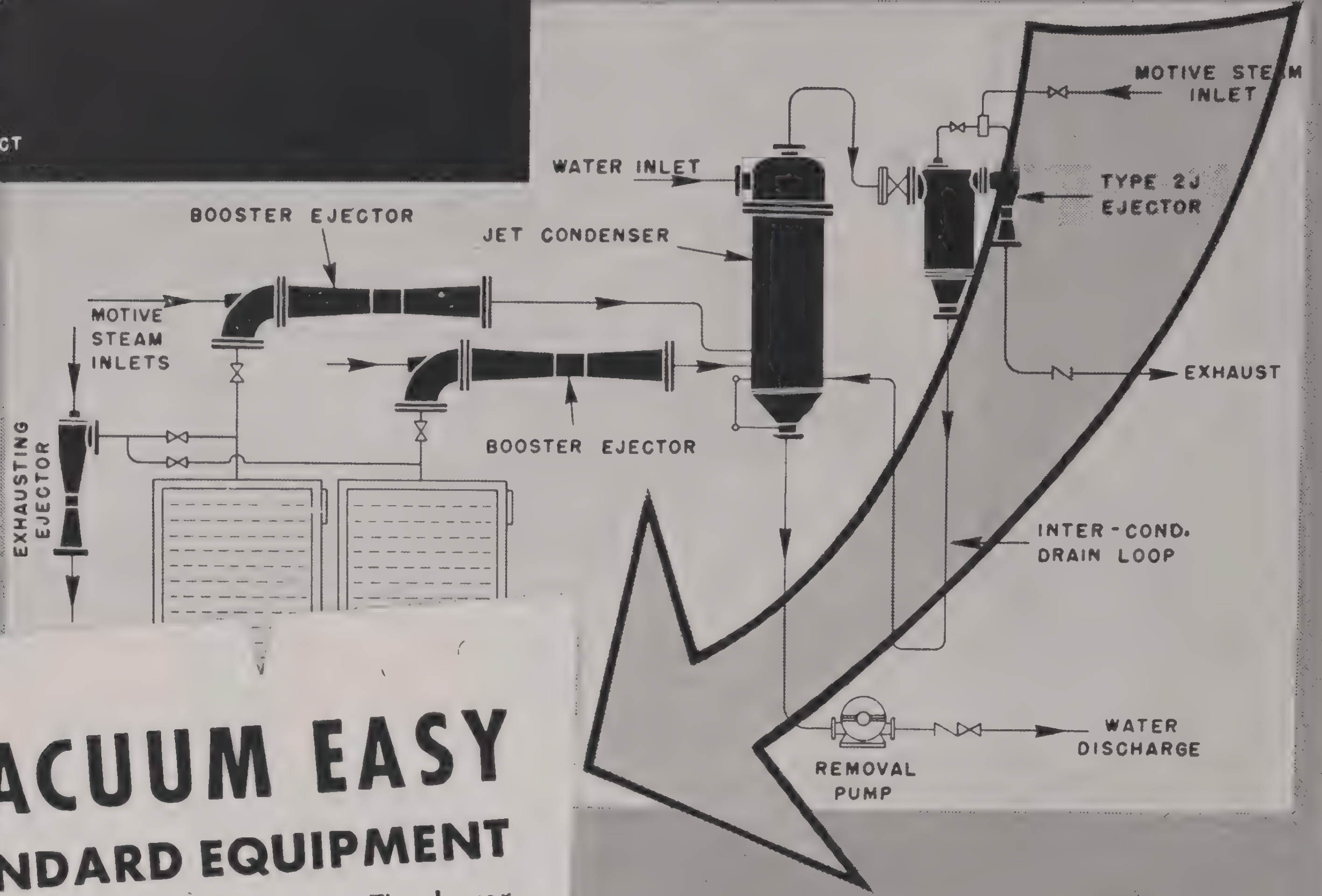
Industrial Rubber Products • Friction Materials • Oil Field Products


ATMOSPHERIC VENT
LIQUID FEED
STEAM
LIQUID LEVEL
SINGLE STAGE EJECTOR
FILTER CAKE
EXHAUST STEAM TO ATMOSPHERE
VACUUM FILTER
AIR SUCTION
FILTERED PRODUCT

SIMPLE? YES

COMPLEX? NO


MOTIVE STEAM INLET
WATER INLET
TYPE 2J EJECTOR
BOOSTER EJECTOR
JET CONDENSER
MOTIVE STEAM INLETS
EXHAUST
EXHAUSTING EJECTOR
BOOSTER EJECTOR
INTER-COND. DRAIN LOOP
WATER DISCHARGE
REMOVAL PUMP

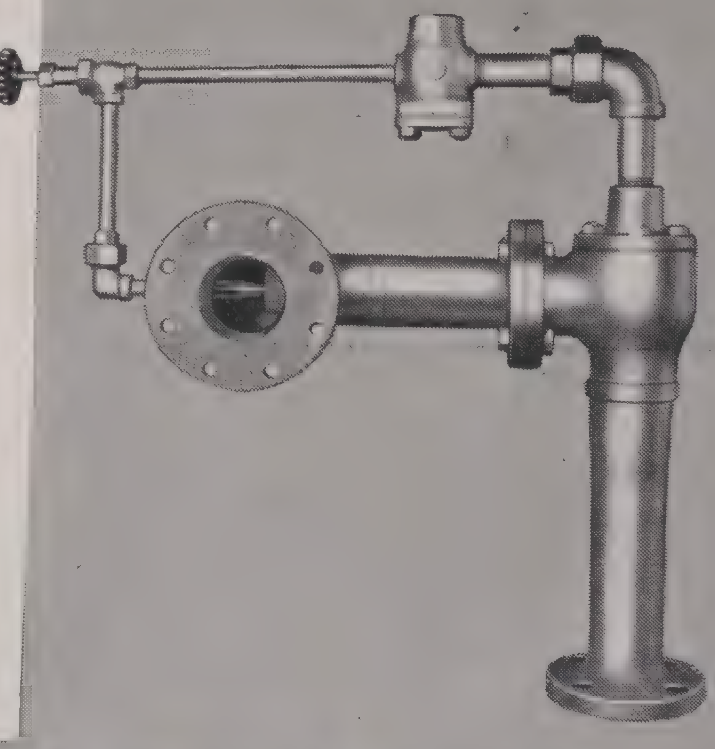
ANY VACUUM EASY

WITH STANDARD EQUIPMENT

Compare the two diagrams shown above. The lower one appears to be quite complex, but actually it isn't complicated at all. It is nothing more than two Booster Ejectors in parallel hookup exhausting to a direct contact Jet Condenser, and a two-stage exhausting Tubejet with Inter-Condenser, for rapid initial evacuation. What's more, all equipment is standard, thus effecting considerable savings in initial cost. C. H. W. experience in engineering high or low vacuum requirements for all types of applications, plus a complete range of sizes of standard units, assures easy and economical solution of all your vacuum problems. Catalog 1462 describes a complete range of standard sizes from single stage units for maintaining pressures down to 3.5 inch mercury, and multiple stages up to five for maintaining absolute pressures below 250 microns. Write for it today.

C. H. WHEELER MANUFACTURING CO.
1828 Sedgley Ave., Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

SINCE 1903



C.H. Wheeler
STEAM CONDENSERS • WATER COOLING TOWERS
EJECTORS • STEAM JET VACUUM REFRIGERATION
OF PHILADELPHIA

VODOL-XX is the exclusive product of Refining Unincorporated

GOLDEN BROWN
Naturally
Free-flowing!

VODOL-XX

Famed throughout the industries as the

CORN-OIL LECITHIN
(BONE-DRY)

IN THEIR OWN PRODUCTS—in continuous use of VODOL-XX over long periods—representative food industries have proved its unequalled advantages to their complete satisfaction. Pure virgin corn oil provides nature's finest lecithin! Processing by Refining Unincorporated has brought its incomparable qualities to perfection.

THE BONE-DRY CHARACTERISTIC OF VODOL-xx positively prevents any moisture disturbance. (Important to the chocolate manufacturer.)

Free-flowing VODOL-xx also means

- No pre-heating, pre-dissolving, straining nor thinning
- Instant solubility at low temperatures
- Ready dispersion in fats
- Freedom from lecithin taste and odor in end product
- Longer shelf-life and freshness

Join the others who have found VODOL-XX the most satisfactory on all counts in

Packing Industries • Baking • Confections • Drugs and Cosmetics
All processing using Lecithin

Judge VODOL-xx in your own plant—at our expense. ***Mail Coupon Today!***

FREE!
VODOL-XX for plant test

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407 S. Dearborn St., Chicago 5, Illinois
Without obligation, I'll be glad to give VODOL-XX a trial in our plant.

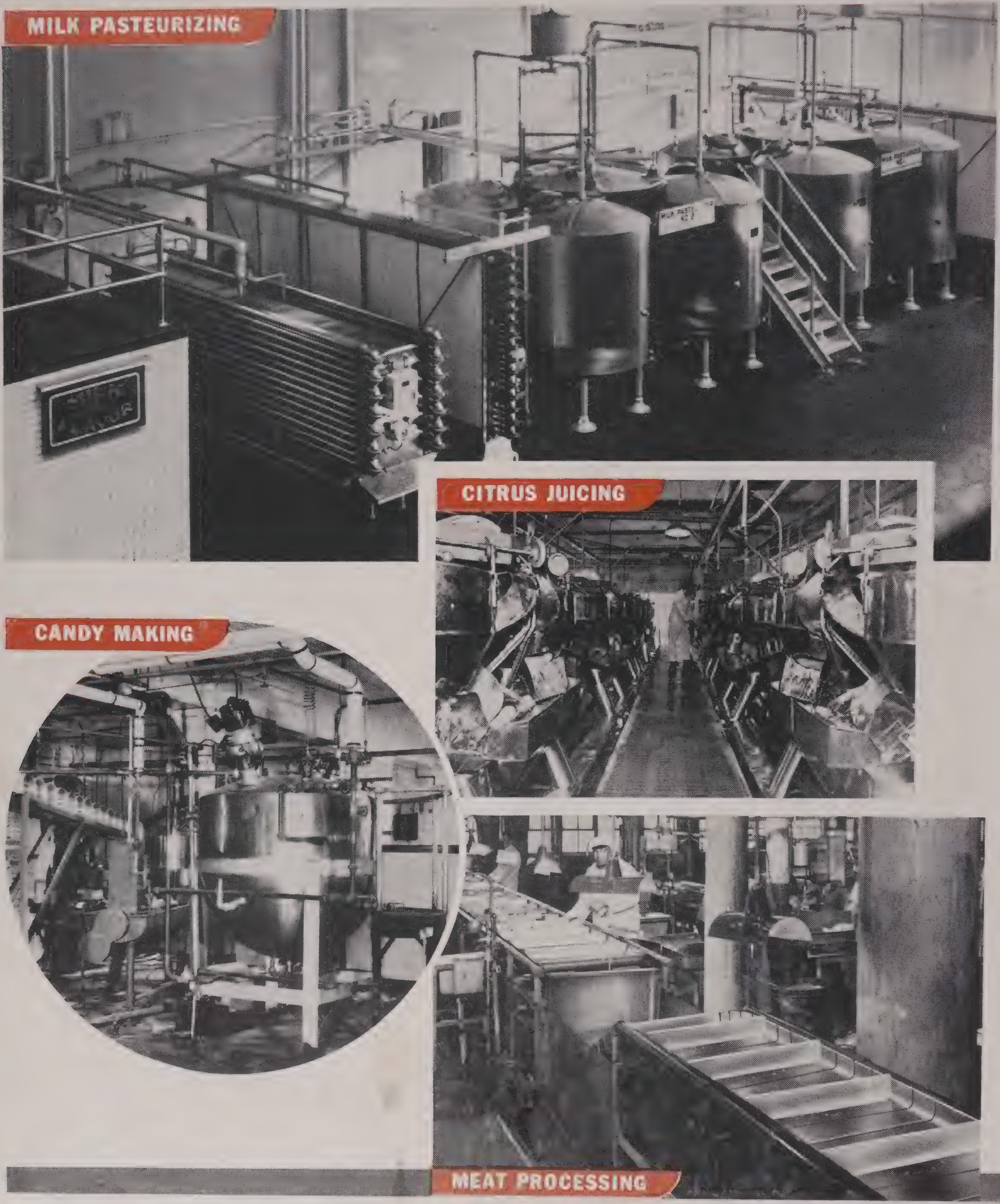
Name ____________________

Position in firm ____________________

Firm Name ____________________

Address ____________________

Always remember... *First cost*


MILK PASTEURIZING
CITRUS JUICING
CANDY MAKING
MEAT PROCESSING

is last cost

with Stainless Steel equipment

TODAY, with the cost of labor and raw materials at an all-time high, it would seem to be out of line to suggest the purchase of equipment that costs more. But it's actually good economics. Because, when you install equipment made of Stainless Steel, you're taking the first step to lower processing costs.

The reason for this is simple. From the day it is installed, your Stainless equipment begins saving you money at a rate that soon offsets any slight additional premium you may have paid for it—and it is cheapest to use from there on.

Stainless Steel's ability to pay extra dividends is the result of its exceptional resistance to the corrosive action of fruit, vegetable and organic acids, *plus* its excellent ability to withstand wear. Together, these characteristics practically eliminate the problems and costs of maintenance. In addition, the ease with which Stainless can be cleaned and kept clean effects important and continuous savings in labor.

VEGETABLE CANNING

For multi-product processing, Stainless equipment has special advantages. It is easily adaptable to all types of material . . . it won't affect the purity, color, flavor or vitamin values of *any* product you happen to be handling. And where appearance is important, Stainless is unsurpassed for its *lasting* good looks.

All these benefits add up. That's why, no matter what food products you are processing, it will cost you less in the long run to use Stainless Steel equipment.

HOW TO OBTAIN THE BEST PERFORMANCE FROM STAINLESS STEEL

United States Steel's manufacturing subsidiaries maintain a staff of chemists, engineers and metallurgists to help the food industry solve its processing equipment problems. They'll advise you on the best type of Stainless Steel for any particular application; how to fabricate and use the material to best advantage; how to adapt equipment and materials to the continuously changing requirements of multi-product processing.

This skilled technical assistance is only one of the advantages you obtain when you specify U·S·S Stainless Steel. In U·S·S Stainless you get a perfected, service-tested material, uniform in finish and in fabricating quality. It permits the widest latitude in design and the employment of the most modern techniques in manufacturing. For the finest performance from Stainless Steel equipment, be sure it's "U·S·S Stainless."

SEND FOR THIS BOOKLET—**If you use or fabricate food handling machinery, you'll be interested in our booklet, "Fabrication of U·S·S Stainless Steels." For your copy, write to United States Steel Subsidiaries, 2122 Carnegie Building, Pittsburgh 30, Pennsylvania.**

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO · CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
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U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

9-1891

UNITED STATES STEEL

TRANSPARENCY
SALES APPEAL
MOISTURE PROTECTION
GREASE PROTECTION
STRENGTH

CELLOPHANE gives you all this in one package

Name your packaging requirements! Whatever your product calls for, there is a Sylvania Cellophane to give it the utmost in protection and gleaming beauty that means sales.

Take Sylvania Cellophane, types MS, DS or P-1, for example. These protective films were engineered with your needs in mind. They are truly transparent . . . offer extra visibility. They resist grease . . . keep your products free from contamination. Their uniform strength makes them easy to apply either by hand or automatic equipment. In addition, types MS and DS offer the heat sealing qualities and the moisture protection necessary for most applications.

Talk over your packaging problems with the Sylvania representative. He'll be glad to help you determine the combination of properties needed for your products. Or write to Market Development, Dept. F-12, for information, mentioning the specific application in which you are interested.

You will find us most cooperative.

Individual cherry pie, all dressed up in type P-1 Sylvania Cellophane bag. Attractively printed design makes an outstanding and economical package.

SYLVANIA CELLOPHANE ®

SYLVANIA CELLOPHANE

SYLVANIA DIVISION AMERICAN VISCOSE CORPORATION
Manufacturers of cellophane and other cellulose products since 1929
General Sales Office: 350 Fifth Avenue, New York 1, N. Y.
Plant: Fredericksburg, Va.

THE BEST LIFT TRUCK FOR INSIDE WORK

MOVE
MORE
MATERIALS

Inside your plant with a HYSTER® LIFT TRUCK

Saves Floors...Cuts Maintenance Costs. More Speed, More Traction, More Maneuverability.

The complete Hyster line of trucks—7 models (2,000 lb. to 30,000 lb. capacity) are gasoline powered; all are equipped with pneumatic tires. Illustrated at top of page is Hyster 20; above, Hyster 40.

The Hyster Pneumatic Tire "Easy Ride" is easy on floors—easy on the load—engineered for greater maneuverability in narrow aisles and crowded warehouse spaces. HYSTER IS THE IDEAL LIFT TRUCK FOR INSIDE WORK.

Big PNEUMATIC TIRES CUT DOWN FLOOR SURFACE REPAIRS, practically eliminate damage to costly floors. TRACTION and RAMP CLIMBING ability is increased. Operator fatigue is reduced.

Your Hyster Distributor will demonstrate a Hyster 20 (2,000 lb. capacity) or a Hyster 40 (4,000 lb. capacity) for your *inside and outside* materials handling jobs. You can check your own savings. SEE FOR YOURSELF or write for literature.

HYSTER COMPANY

THREE FACTORIES

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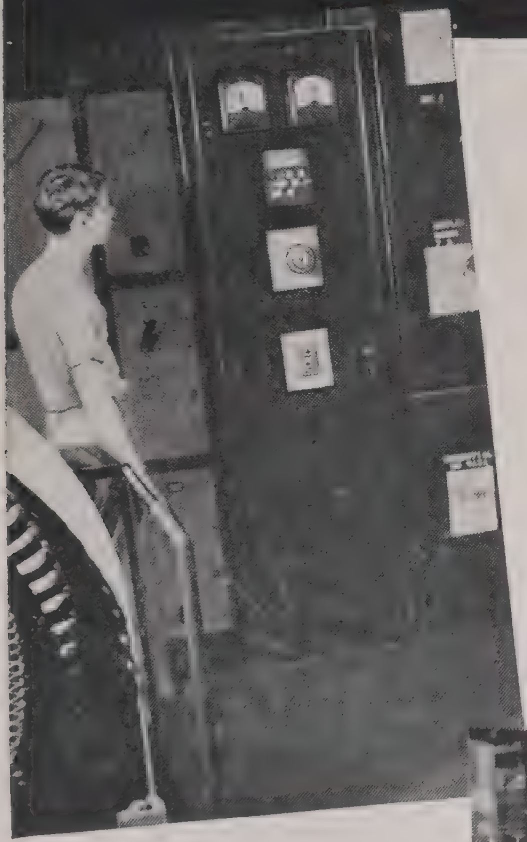
1802-35 NORTH ADAMS STREET........PEORIA 1, ILLINOIS
1010-35 MEYERS STREET............DANVILLE, ILLINOIS

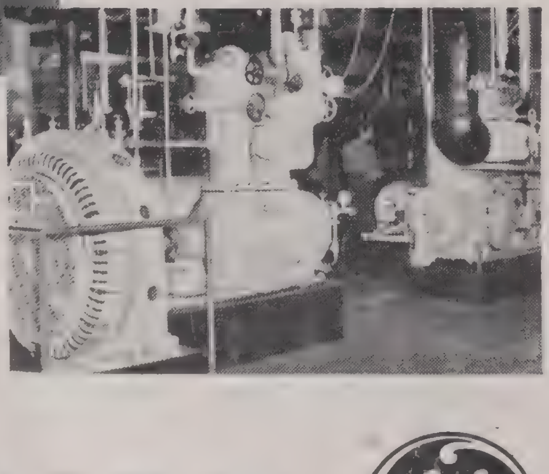
in frozen-juice processing, too, G-E drives help "keep it continuous"



For reliable performance and close quality control, G-E equipment is used practically throughout at Vacuum Foods

Here's an example of a food plant that decided to "go continuous" right from the start. It's the Vacuum Foods Corporation plant at Plymouth, Florida, processing Minute Maid frozen orange-juice concentrate. As many others have done, it turned to General Electric to supply and co-ordinate practically all its electric equipment. Now this plant, too, knows how G-E motors and control can help keep a processing line running at top capacity, contribute to uniform product quality.

If *you* are planning on "going continuous" to reduce handling costs in your food plant operations, it will pay you to check first with a G-E sales engineer. Backed by a staff of engineers specializing in the food industries, he can help you obtain the many advantages of continuous processing methods at lowest cost—by efficient application of G-E motors and control. Call him at your nearest G-E office. *Apparatus Dept., General Electric Company.*

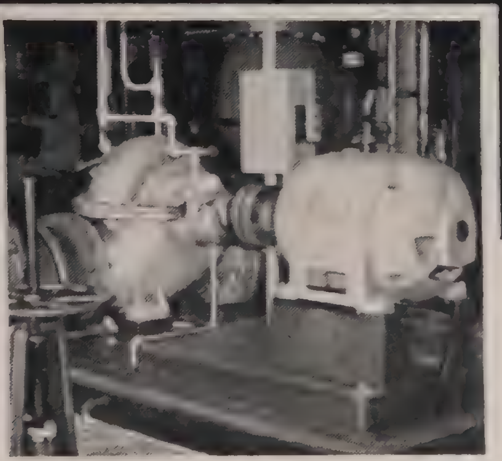


Direct-mounted on a refrigerator compressor at Vacuum Foods is a 100-hp G-E synchronous motor for maintaining exact speeds and correcting power factor. Its control panel (above) is typical of many G-E controls in the plant that help keep operations flowing smoothly.

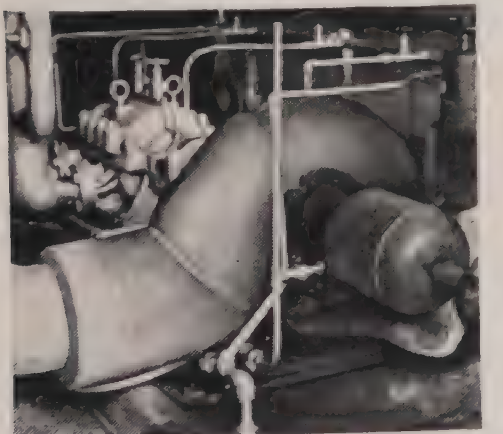
Food Plant Drives

GENERAL ELECTRIC

Pumps shown here that circulate juice at high speed through a vacuum evaporation system are driven by a group of 2-hp G-E totally enclosed fan-cooled motors. In cast-iron construction that resists corrosion, and protected against dripping or splashing liquids, these sturdy motors require only a minimum of maintenance.



With 3500 gallons of water per minute needed, pump motors must be especially dependable. This 75-hp G-E Tri-Clad open (dripproof) motor, one of many throughout the Vacuum Foods plant, provides a high degree of service continuity in driving pumps for the water circulating system.



Here, a 40-hp G-E mechanical drive turbine drives one of the plant's boiler feed-water pumps. For food plants using process steam, G-E turbines provide a reliable, low-cost machine drive while also acting as a reducing valve to furnish low-pressure process steam.

G-E Battery Chargers for electric trucks

KEEP EM ROLLING

At the Vacuum Foods Corporation plant in Plymouth, Florida, frozen orange-juice concentrate is moved quickly and continuously by means of electric battery trucks. To help insure the uninterrupted service needed for top-capacity production, the plant makes extensive use of its G-E copper-oxide battery-charging equipment. Among its many advantages that have "sold" Vacuum Foods are these:

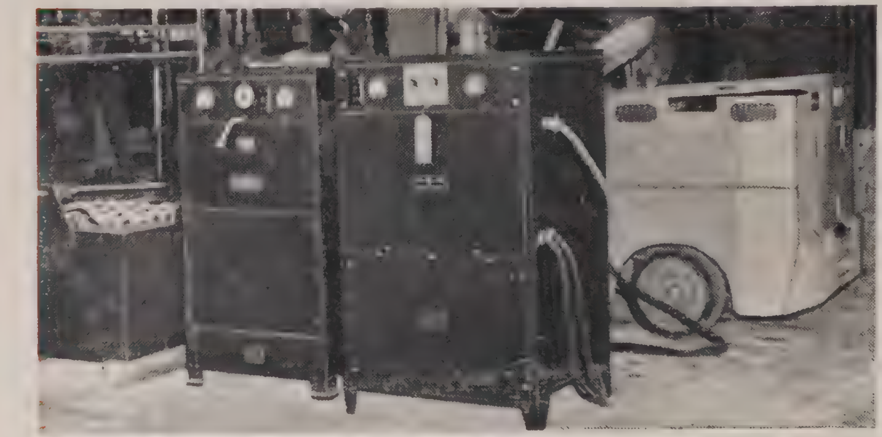
Fully automatic. After operator sets a control, the charger takes over, delivers the charge, and then shuts itself off.

Easy to use. Operator just plugs in the cable leads, and the charger does the rest. No special equipment is needed for installation.

On-the-spot charging. Units can be easily moved, or placed strategically to be ready and handy when needed. No time or manpower is wasted running trucks to and from a central charging station.

Long life. The G-E copper-oxide stacks—heart of the charger—have exceedingly long and dependable service life. Nothing moves except a fan, so there's little to wear out and be replaced.

General Electric's complete line of battery-charging equipment, including motor-generator types, is available through your truck dealer or distributor. Bulletin GEA-5249 gives complete information.



The low cost of G-E copper-oxide battery chargers, like these two at Vacuum Foods, is quickly amortized by savings in time, faster movement of materials, and more efficient use of manpower.

See "Materials Handling"! How electric trucks and other modern materials handling equipment boost productivity is shown in this G-E sound and color motion picture. Your nearest G-E office will gladly arrange for a showing.

More Power to America

WANT MORE DATA?

General Electric Company, Section B 652-2
Apparatus Department, Schenectady 5, N. Y.

Please send me the following bulletins:

☐ GEA-3580—Tri-Clad induction motors
☐ GEA-4322—Electric equipment for the food industry
☐ GEA-5249—Copper-oxide battery chargers

Name ....
Company ....
Street ....
City .... State ....

WHAT FOOD-PROCESSING JOB WOULD YOU LIKE TO DO FASTER—BETTER—AT LESS COST?

Whatever it is, chances are that Rohm & Haas Commercial Enzymes can help you. For more than 40 years these versatile biocatalysts have been production expediters, quality and yield improvers, and cost cutters in scores of natural product processes.

For example:—Fruit Juices and Concentrates, Wines, Jellies and Low Solids Gels, Baking, Brewing, Distilling, Ice Cream, Whey, Cheese, Meat, Protein Hydrolysates

Enzymes Make It Easy to...

Solubilize Starches *or convert them to sugar in peas, corn, wheat and other grains.*

Modify proteins—*or hydrolyze them—in meat, animal guts, casein, lactalbumin or legumes.*

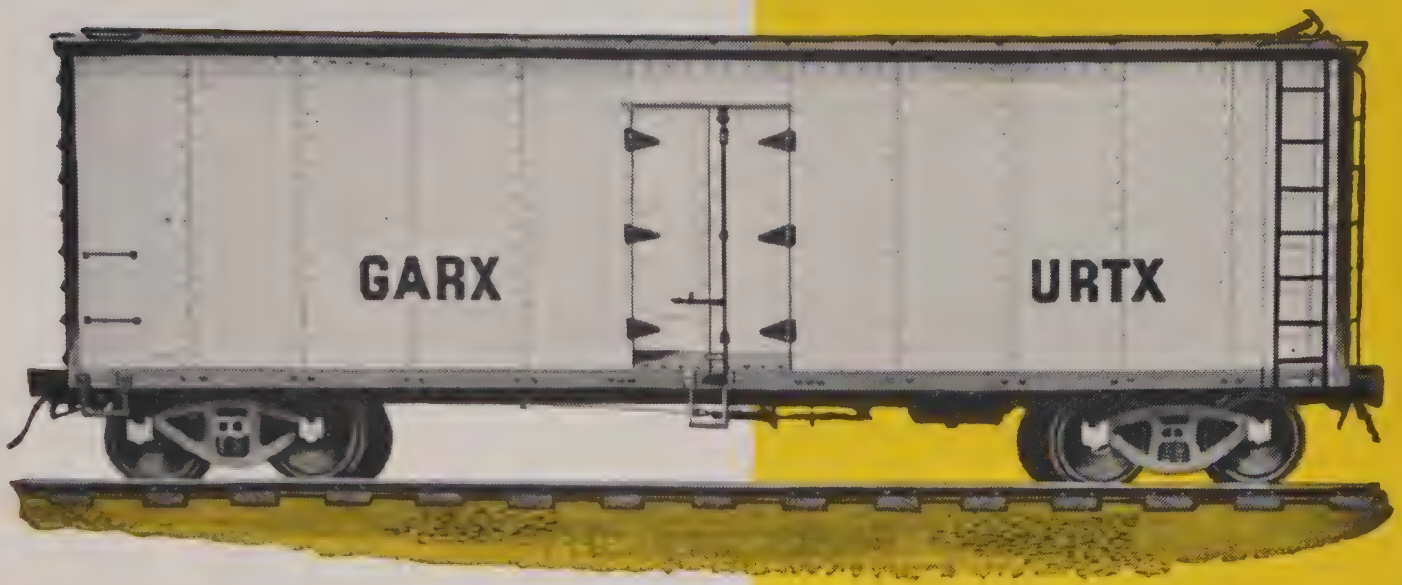
Hydrolize pectins *in fruits, fruit juices or concentrates, and wines.*

Enzymes are short-cuts to better processing. No one knows their *full* potentialities, but our 40 years experience and research have taught us much that we shall be glad to pass on to you. Write today for your test sample of Rohm & Haas Commercial Enzymes. Test them in your processing. Then make a note to discuss your specific problem with our technically trained representative—or, if you wish, phone or write us direct. No obligation, of course.

CHEMICALS FOR INDUSTRY

ROHM & HAAS
COMPANY
WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Along with many other specialized types of General American cars, this refrigerator car serves the nation's shippers.



GENERAL AMERICAN

builds and operates specialized refrigerator cars for shipments of all kinds of perishables

Whether you ship fruits or vegetables, meats or liquids, there is a General American Refrigerator car equipped to handle your products.

To serve you further, General American representatives located in most major producing areas are ready to help you solve your own individual shipping problems quickly and economically.

So whatever and wherever you ship, you may take advantage of General American's 50 years of experience serving the nation's shippers. And you may rely absolutely on General American's outstanding reputation for complete dependability.

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GENERAL AMERICAN
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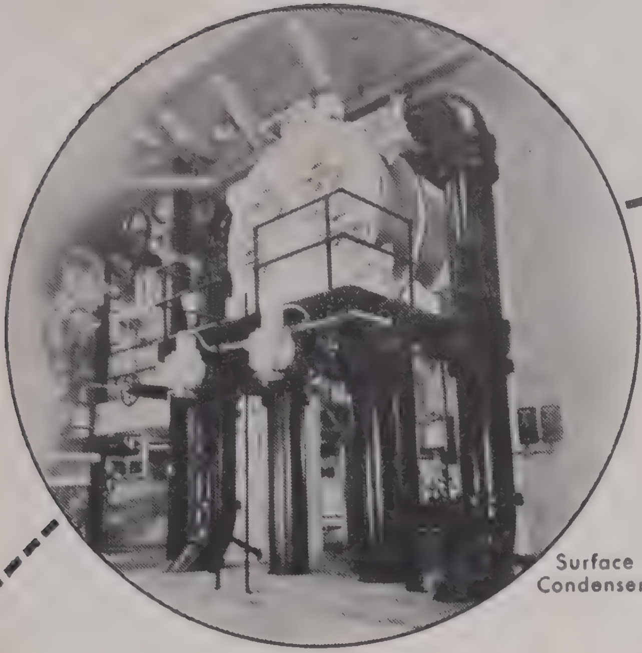
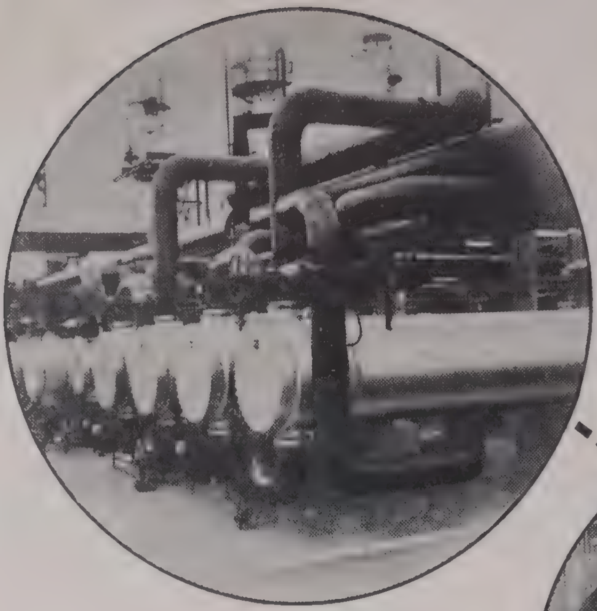
UNION REFRIGERATOR
TRANSIT LINES,
MILWAUKEE

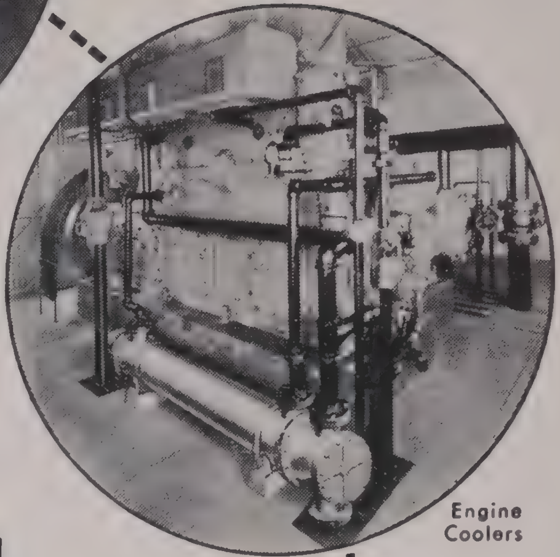
A Division of General American
Transportation Corporation, Chicago 90



Surface Condensers



Refinery Exchangers



Engine Coolers

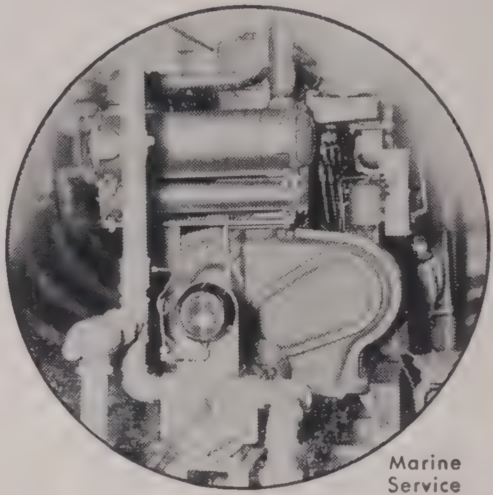
For Your Own Use, Or On The Machines You Make To Sell

YOU'LL GET JOB-MATCHED PERFORMANCE FROM THESE STANDARDIZED EXCHANGERS

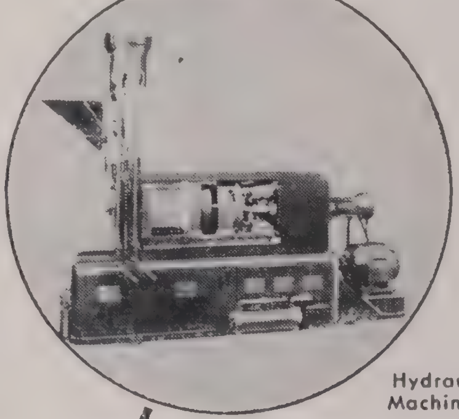
For a big 27,000 sq. ft. surface condenser down to a little 2-inch oil cooler, Ross standardization today means new highs in job-matched performance and new lows in unit costs.

You may be outfitting a power plant, a petroleum refinery or a chemical plant requiring large capacity heat exchanger equipment . . . or you may be selecting smaller exchangers as accessories for the Diesels, compressors or hydraulic equipment which you use or make for sale to others. Neither the size, nor the type of service, nor the operating conditions present a challenge to Ross standardization . . . for Ross has standardized *successfully* on practically everything that is required in heat exchanger equipment.

This means, naturally, that the time-robbing, cost-mounting aspects of custom fabrication are avoided wherever Ross standardization suffices . . . and it more than suffices in most instances. But, where it doesn't, you still have available the industry-leading experience in special engineering and custom fabrication for which Ross has been known some 30-odd years.



Marine Service



Hydraulic Machinery

★ **PREVIEW ROSS STANDARDIZATION** by requesting free Bulletin 4300, then review it with a Ross engineer who will gladly consult. ROSS HEATER & MFG. CO., INC., Division of American Radiator & Standard Sanitary Corp., 1443 West Ave., Buffalo 13, N. Y. In Canada, Horton Steel Works, Ltd., Fort Erie, Ont.

ROSS

EXCHANGERS. . . **MAKE OTHER PRODUCTS BETTER**

Serving home and industry

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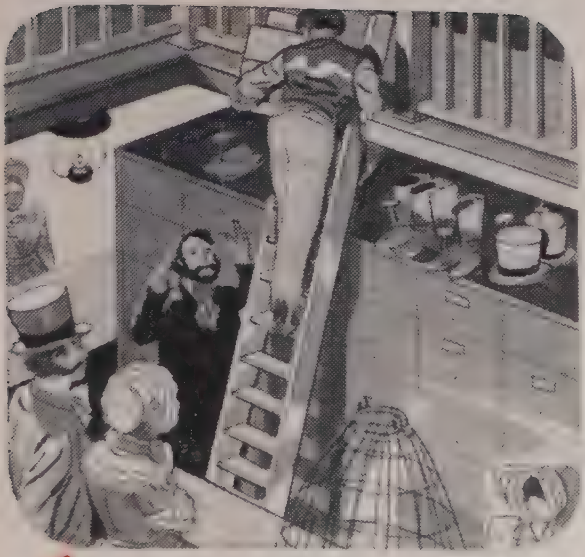
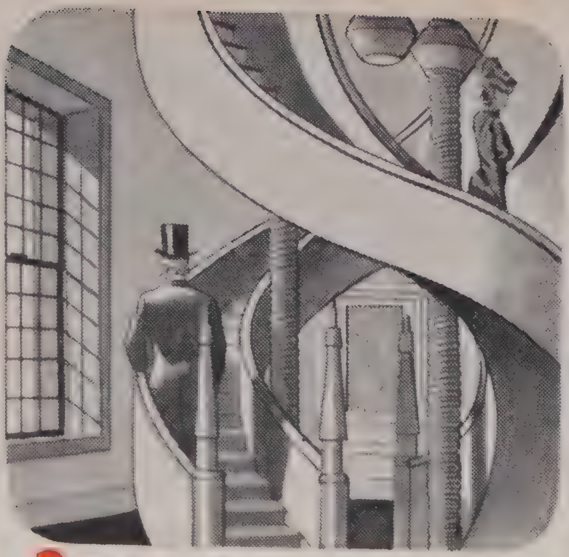
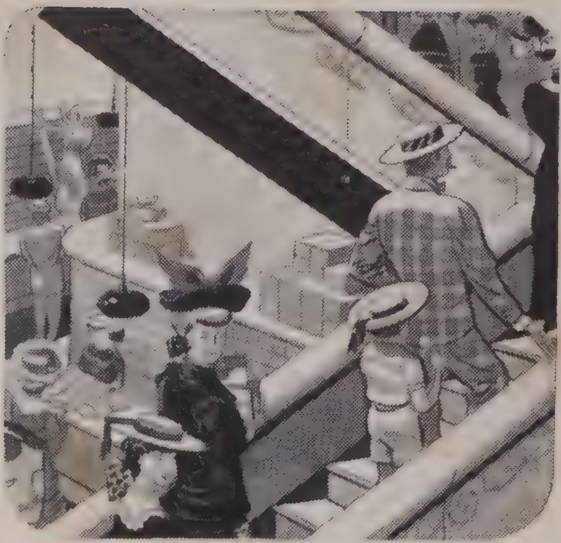


1 1800—For centuries, steps were man's main means of going up. First came the ladder; later, crude steps formed stairways. Even so, man still had to ascend a step at a time under his own power.

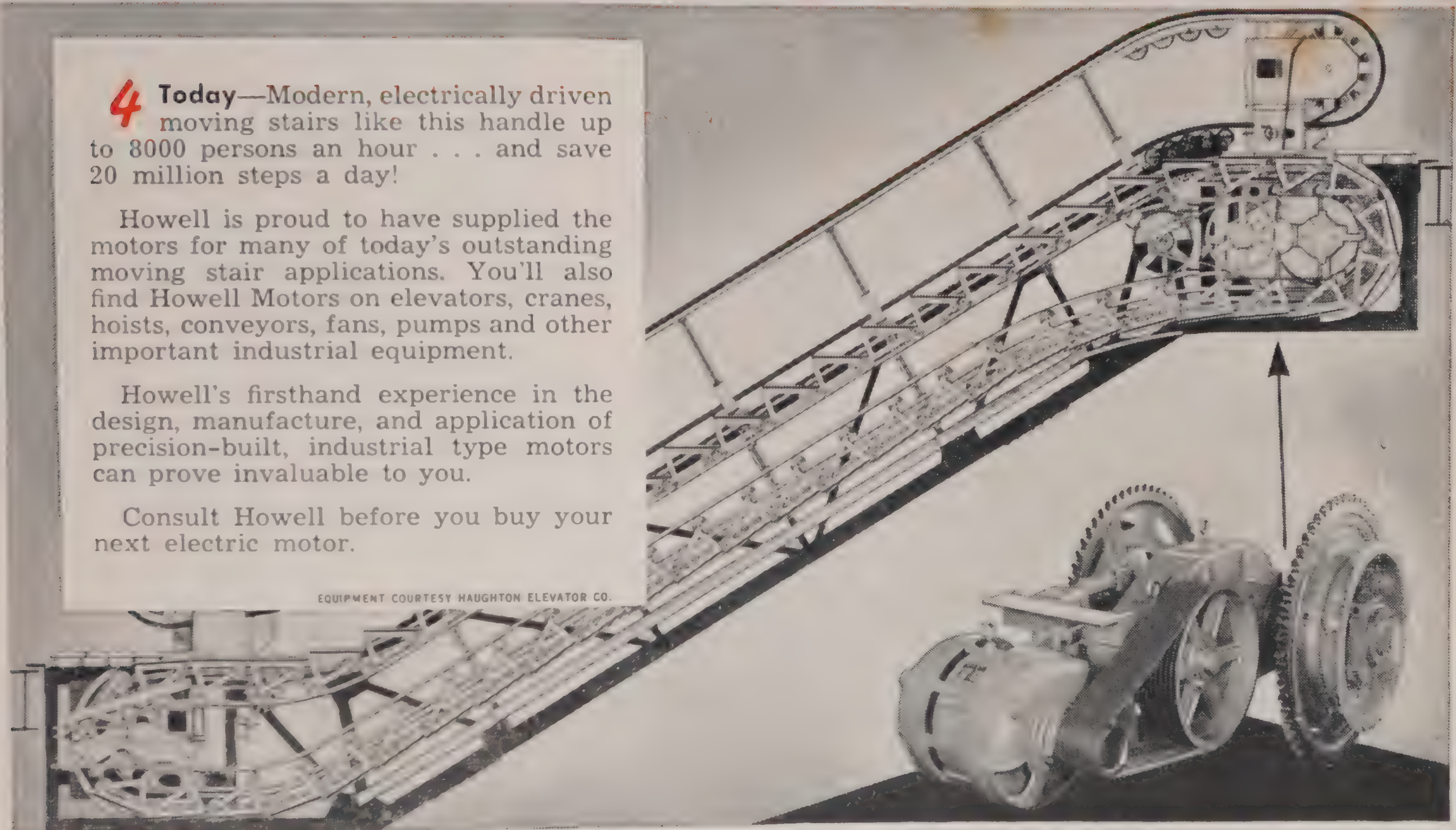


2 1875—Stairways took all forms—straight, spiral, plain and ornate. Then, one Samuel Gray patented an "elevator and moving stairway." Though impractical, his idea set others to work.



3 1901—The forerunner of today's moving stairs was installed in a New York store. By 1915, Howell "Red Band" Electric Motors arrived. Soon, these rugged motors were widely applied.

SAVED...20 MILLION STEPS A DAY!



4 **Today**—Modern, electrically driven moving stairs like this handle up to 8000 persons an hour . . . and save 20 million steps a day!

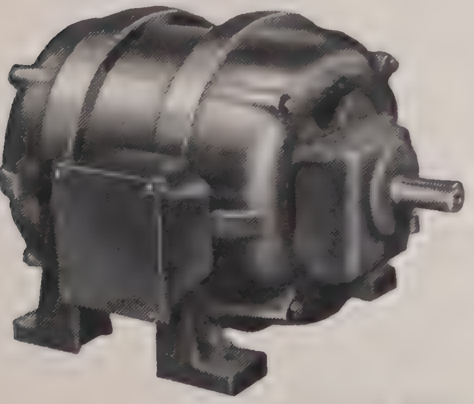
Howell is proud to have supplied the motors for many of today's outstanding moving stair applications. You'll also find Howell Motors on elevators, cranes, hoists, conveyors, fans, pumps and other important industrial equipment.

Howell's firsthand experience in the design, manufacture, and application of precision-built, industrial type motors can prove invaluable to you.

Consult Howell before you buy your next electric motor.

EQUIPMENT COURTESY HAUGHTON ELEVATOR CO.

Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.

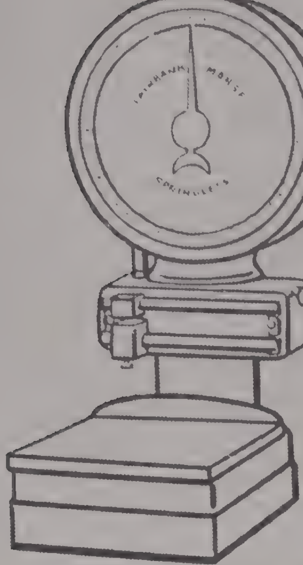


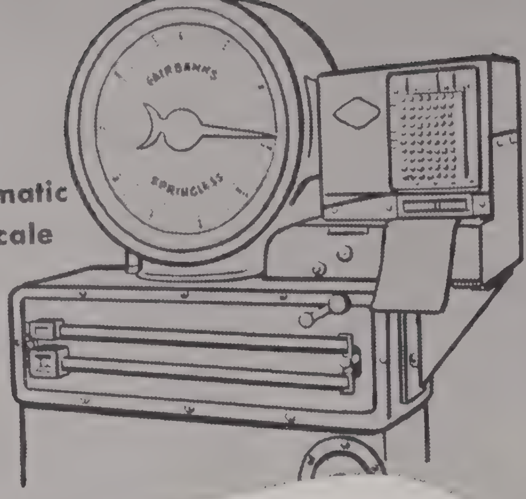
Elevator Type Motor

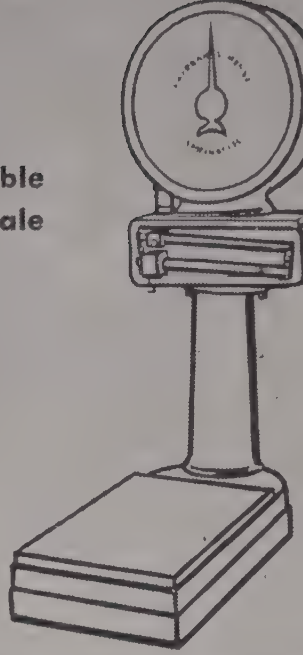
HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.
Precision-built Industrial Motors Since 1915

HOWELL *Red Band* MOTORS


Bench Scale


Printomatic Dial Scale


Portable Dial Scale

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FAIRBANKS-MORSE Scales

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There is a Fairbanks-Morse Scale for every weighing operation. Your Fairbanks-Morse weighing expert will be glad to assist you in selecting the right style and size for your operations. Fairbanks, Morse & Co., Chicago 5, Ill.

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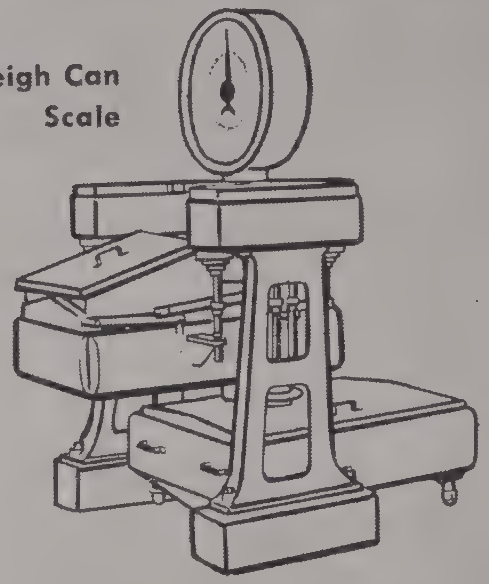
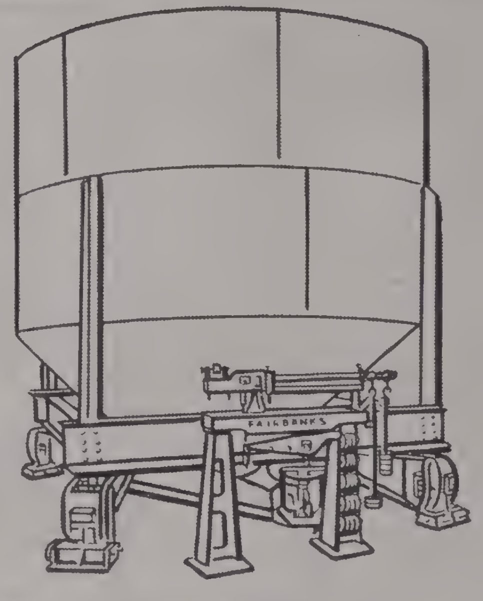
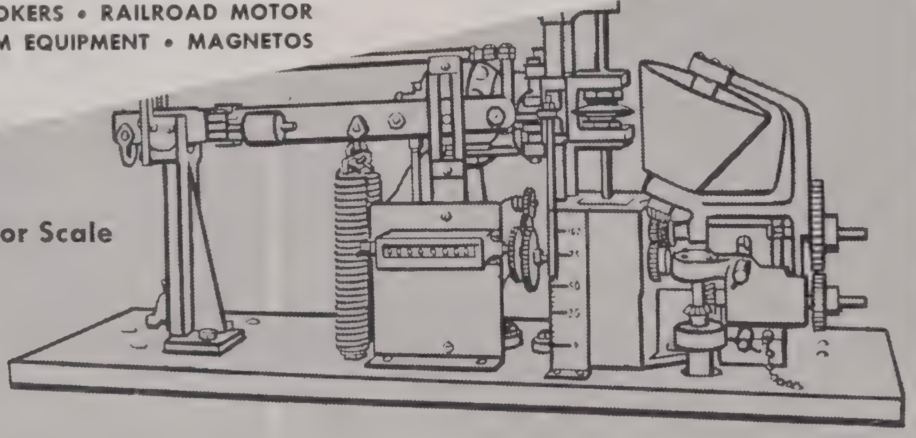
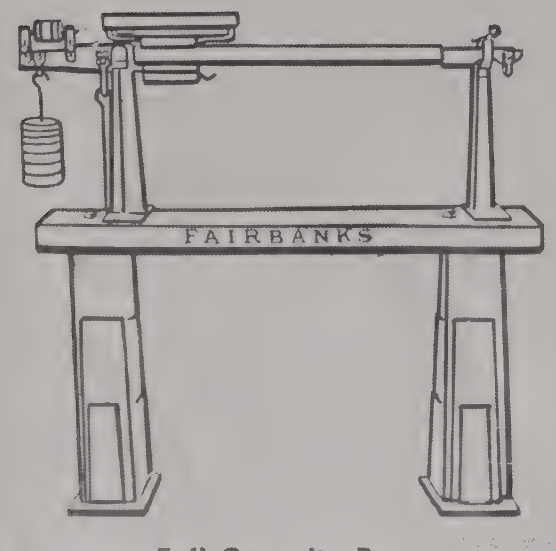

Weigh Can Scale

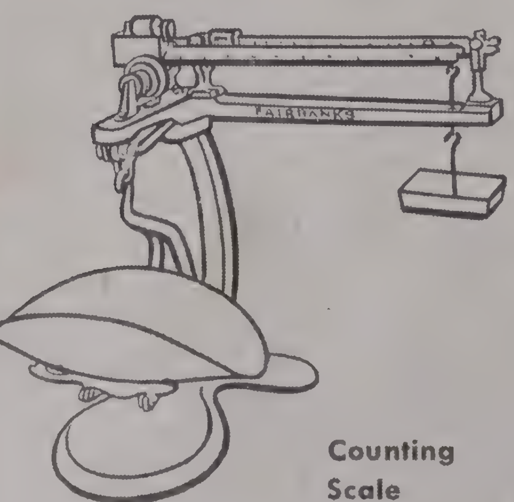


Hopper Scale

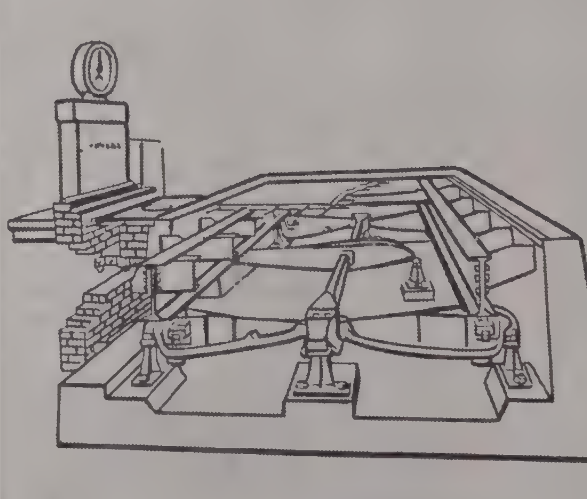

Belt Conveyor Scale



Full Capacity Beam



Counting Scale


Truck Scale

FRUIT JUICES
JAMS
JELLIES
MARGARINE
PICKLES
PRESERVES
RELISHES
FOUNTAIN SYRUPS

they'll keep better...with

MONSANTO

SODIUM BENZOATE

If you make fruit juice, preserves, pickles, margarine, beverages or other food products subject to spoilage, you can insure storage and shelf-keeping qualities by using Monsanto Sodium benzoate. Sodium benzoate is a preservative for food products that is permitted by federal law.

Monsanto's sodium benzoate is *pure.* It does not change the taste of your products nor reduce their nutritional values. It is absolutely harmless to human beings in amounts customarily required for food preservation.

Sodium benzoate has been the standard preservative in the food industry for three decades. It is available from Monsanto in either powder or flakes. Many food processors prefer flakes because they are dustless . . . because they dissolve more rapidly.

If preserving is a problem in your plant, write for a copy of "Preserving With Monsanto Sodium Benzoate." It is filled with useful information and suggestions. For your copy, mail the coupon, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk M, Organic Chemicals Division, 1737 South Second Street, St. Louis 4, Missouri.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS AND PLASTICS

MONSANTO CHEMICAL COMPANY
Desk M, Organic Chemicals Division
1737 South Second Street, St. Louis 4, Missouri

Please send: ______Folder, "Preserving With Monsanto Sodium Benzoate"; ______Sample and quotations on sodium benzoate flakes and powder.

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*Company*______________________________

*Street*______________________________

*City*__________________*Zone*_____*State*________

SERVING INDUSTRY...WHICH SERVES MANKIND

WORTHINGTON

REFRIGERATION REPORT

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY

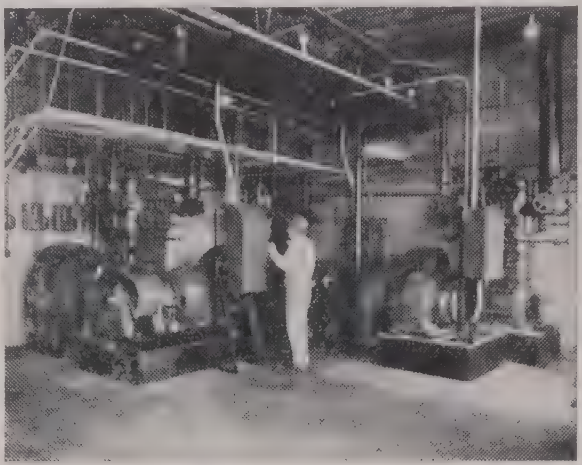
Specialists in air conditioning and refrigeration for more than 50 years

Putting A Quick Freeze On Perishables

In 16 minutes flat, Worthington compressors freeze peas, corn, strawberries, cauliflower and boysenberries at Kelley, Farquhar & Company in Salem, Oregon.

To provide the extreme cold for the quick-freezing and low-temperature air (minus 6° F) for a 100' x 120' x 14' storage room are five Worthington compressors—three 8½ x 8 vertical duplex ammonia compressors and two 17 x 11 horizontal single-stage ammonia booster compressors.

Kelley, Farquhar & Co. have recently installed an additional 7 x 7 vertical ammonia compressor to hold the storage temperature during the winter months. This compressor was added so that it would not be necessary to use a large compressor during these months, thus realizing a substantial saving in operating cost.



Three Worthington 8½ x 8 vertical ammonia compressors at Kelley, Farquhar & Co., Salem, Oregon

How They Keep Fish Fit In Atlanta, Georgia

When, for the fifth time in 21 years, increased volume of business made it necessary for the Capitol Fish Company of Atlanta to go into new quarters, the management took advantage of the opportunity to install the most modern machinery for freezing and storing fish and other quick-frozen commodities under closely controlled temperature conditions.

Worthington 8" x 8" Ammonia Compressor for zero temperature storage rooms

For the refrigeration compressors, Worthington equipment was selected by the consulting engineer, C. T. Baker of Atlanta.

The freezing takes place in a room containing approximately 430 square feet and having a freezing capacity of 15 tons a day. Temperature is maintained at minus 28 to 30° F by means of a Worthington 4¾" x 3⅝" 6-cylinder ammonia booster compressor, operated at 720 rpm and rated at 12½ tons refrigeration at minus 41° F suction temperature.

Zero temperature storage rooms are served by two Worthington 8" x 8" single-acting vertical ammonia compressors, rated at 26.6 tons each and operating at 5 psi suction, 185 psi discharge pressure. They are driven by electric motor through V-belts. Starting and stopping are controlled by thermostat, providing a narrow pre-determined temperature range.

The high temperature storage rooms and the vestibule connecting the rooms are cooled by a 4" x 4" twin-cylinder Worthington Ammonia Compressor operating at 400 rpm.

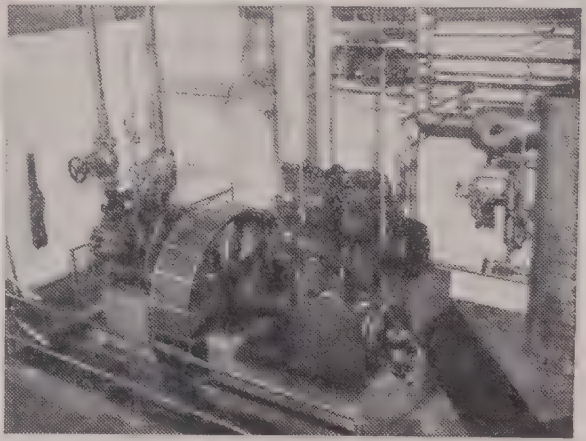
Two Good Catches Bring Cheers

The good "catch" Del Mar Canning Co. made in selecting Worthington refrigeration equipment for its new fish packing plant at Warrenton, Oregon, evidently is as pleasing to company executives as its catch of tuna, salmon, sardines and crabs.

Del Mar Canning Co., Warrenton, Oregon

"These machines have given excellent service," reports one Del Mar executive, referring to the three Worthington refrigeration compressors used for freezing whole fish and fillets, and for making ice. The Worthington equipment includes one 10 x 10 and one 7 x 7 vertical ammonia compressor and 1 ammonia booster compressor. This plant has a storage capacity of 800 tons of fish.

A-9.19



Worthington Ammonia Booster Compressor at Del Mar Canning Co.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

A complete line . . . in which *all* the vital components are *made*, not just assembled by Worthington. For more worth with Worthington, see your nearby Worthington distributor (consult Classified Telephone Directory).

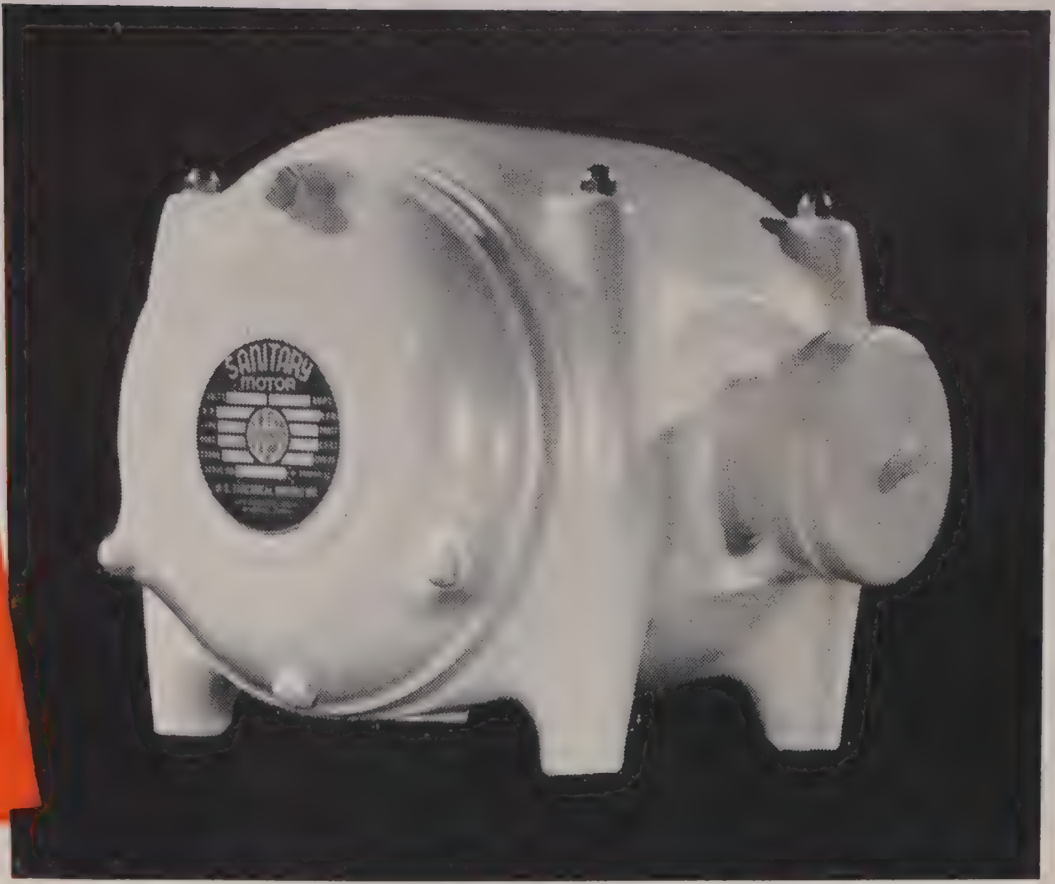
Announcing

a **SPECIAL MOTOR**

designed for

FOOD PLANT

PROTECTION



FOR EXTREME SANITATION

A TOTALLY NEW CONCEPT OF CLEANLINESS FOR PRODUCT PROTECTION TO MEET EVERY DEMAND OF SANITATION AUTHORITIES

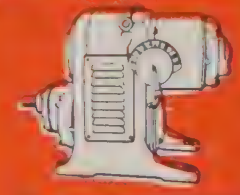
Where strict *sanitation* is a prime requisite and where equipment must be "hosed down," the new U. S. Sanitary Motor meets *all* requirements. It has been designed to comply with and actually exceed minimum specifications of sanitarians, and 3A standards. Beautiful in appearance and extremely immaculate, this revolutionary motor can be installed in any location without fear of damage from water or moisture. It is devoid of external pockets, grooves or any area where dirt or bacteria might collect. Its attractive external housing enhances the appearance of the driven machine.

UNMATCHABLE IN FLOWLINE PERFECTION

Note the absence of abrupt shoulders and crevices. There's no place where water or contaminants can lodge. The exterior is elegantly streamlined and immaculately finished in corrosion and abrasion-resistant baked white enamel. Joints are machined flush. Every part has been designed with meticulous care.

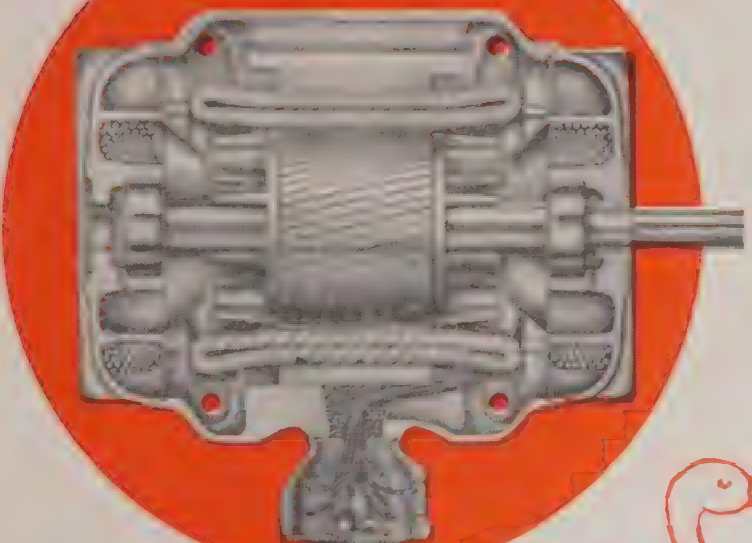
EASY TO INSTALL ANYWHERE

Although compactly designed, the feet are of sufficient length to permit ample clearance under the motor for easy cleaning. Can also be wall mounted.



U. S. VARIDRIVES
2 to 10,000 rpm's
at your command

Type CP



Sheds water like a duck

U.S. Sanitary MOTOR

TOTALLY-ENCLOSED-TYPE CT
SPLASH-PROOF-TYPE CP
MACHINED FLUSH JOINTS
ASBESTOS-PROTECTED WINDINGS
FULLY MOISTURE-RESISTANT
RUST-PROOF FOREVER
UNIVERSAL MOUNTING
MEET NEMA STANDARDS
SEALED TERMINAL BOX
FACE TYPE BRACKETS
SELF DRAINING
½ TO 7½ HORSEPOWER

U.S. ELECTRICAL MOTORS Inc.

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Enduro
REG. U. S. PAT. OFF.

REPUBLIC
STEEL
REG. U. S. PAT. OFF.

STAINLESS STEEL HOLDING TANKS in this large midwestern ice cream plant protect product quality . . . are easy to keep sparkling and sanitary . . . require little or no maintenance. They are typical of countless cost-saving ENDURO applications throughout the dairy and food industries. Other applications include tanks, kettles, vats, hoppers, piping, valves, fittings—practically all types of processing and packaging equipment which come in contact with foods and food products.

Enduro-THRIFTY METAL OF 10,000 USES

EASY TO CLEAN...AND EASY TO KEEP CLEAN!

Gleaming, sanitary Republic ENDURO Stainless Steel is a material of many advantages—for many uses. High among the reasons for its universal adoption is its inherent cleanliness. This makes it easy to clean and easy to keep clean.

With ENDURO equipment, ordinary soap and water usually are all that's needed to restore its bright, non-contaminating surfaces. Under normal conditions, strong caustic agents and special scrubbing compounds are unnecessary to remove every trace of food oils or acids. Clean-up time—*costly non-productive time*—is cut to a minimum.

Check each of the 10 ENDURO advantages listed below. You'll quickly see why you save money in the long run by specifying ENDURO Stainless Steel on your new equipment orders. For detailed information, specifically related to your own operations, write us today.

REPUBLIC STEEL CORPORATION
Alloy Steel Division • *Massillon, Ohio*
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

STAINLESS STEEL

✓ Check ALL 10 Advantages: • RUST AND CORROSION-RESISTANCE • HEAT-RESISTANCE • HIGH STRENGTH • EYE APPEAL NO METALLIC CONTAMINATION • SANITARY SURFACES • EASY TO CLEAN • EASY TO FABRICATE • LONG LIFE • LOW END COST

STAINLESS STEEL
101

figure all the Angles and you'll get a CHERRY-BURRELL Round Processor

Now is the time to increase plant efficiency . . . improve your product and cut costs with a modern, multi-purpose Cherry-Burrell Round Processor. Here is an efficient, completely sanitary processor for mixing, heating, cooling, holding or pasteurizing a variety of products: liquid foods, syrups, salad dressings, beverages, etc. Extra heavy construction and simple design assure years of trouble-free operation with a minimum of maintenance. Consider these few among many outstanding *plus* features:

EXTRA FAST HEATING

Large heat transfer surfaces, patented spray type or direct steam heating assure fast, uniform heating and cooling . . . pasteurizing without "burn-on."

ADVANCED SANITARY DESIGN

. . . eliminates stuffing boxes, rotary seals and other unsanitary features. Smooth, easy to clean, all-stainless interiors. And the round shape saves space, too.

STRONG POSITIVE AGITATION

Powerful sweep type agitator swiftly circulates the product for faster, uniform heating. Ruggedly designed to handle the heaviest bodied product.

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FACTORIES, WAREHOUSES, BRANCHES, OFFICES
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trendmaker in a great industry

Cherry-Burrell Corporation
Dept. 117, 427 West Randolph St., Chicago 6, Ill.
Send Round Processor Bulletin.

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Food
Industries

DECEMBER, 1949

Problem of Chemicals Is Tough One for Processors

Food technologists are right smack up against one of the toughest problems the industry ever has been called upon to solve. There is irony in the situation, too, since the problem is one created by scientific advances. We refer to the potential and alleged health hazards resulting from chemicals in foods.

At the recent meeting of American Public Health Association, Dr. James R. Wilson, secretary of the Council on Foods & Nutrition of the American Medical Association, called particular attention to benzene hexachloride, which stays in some soils throughout the winter and may contaminate a second season's crop. He also put the finger on DDT, which tends to remain on the surface of fuzzy skinned fruits, or which may be excreted by dairy cattle into milk. And he called attention to thiouracil and thiourea, which have been suggested as aids to farmers in fattening meat animals.

As Dr. Wilson observed, the number of possible contaminants is growing rapidly, and knowledge concerning the safety or lack of safety of many is fragmentary.

In addition to accidental contamination of foods, there is the recently much-publicized problem of whether certain chemicals, such as emulsifiers, used as ingredients or conditioners in processed foods are harmless. There is evidence to indicate that certain emulsifiers not only are harmless but have nutritional value. However, this situation remains to be officially clarified. Food processors expect the bread standards, when eventually issued, to indicate the attitude of the Food & Drug Administration toward these so-called chemicals—and processors other than bakers are concerned. But at best, the bread standards will apply only to the specific chemicals considered at the bread hearings. Others used in the food industry, or yet to be introduced, will keep the problem hot for a long time to come.

The coming hearing on insecticides undoubtedly will help to clarify the problem of chemicals in foods, at least to the extent of consolidating the available data. That is why people in industry consider this hearing so significant and why they think it will be a long-drawn-out affair.

In any event, the problem of protecting consumers against new ingredients or contaminants in foods must rest to a large extent in the laps of food processors and those chemical companies which introduce new insecticides, ingredients or conditioners. Most manufacturers have accepted this responsibility, but a few have taken it too lightly.

It is the size of the job which makes it necessary that all take a hand. One authority estimates that adequate tests of all chemicals would tax the pharmacological facilities of the entire country.

Under the current food and drug law, a proposed new drug is banned from general use until its safety and efficacy has been established. And W. B. White, Chief of the Division of Food of the Food & Drug Administration, believes that some such device is badly needed for proposed chemicals.

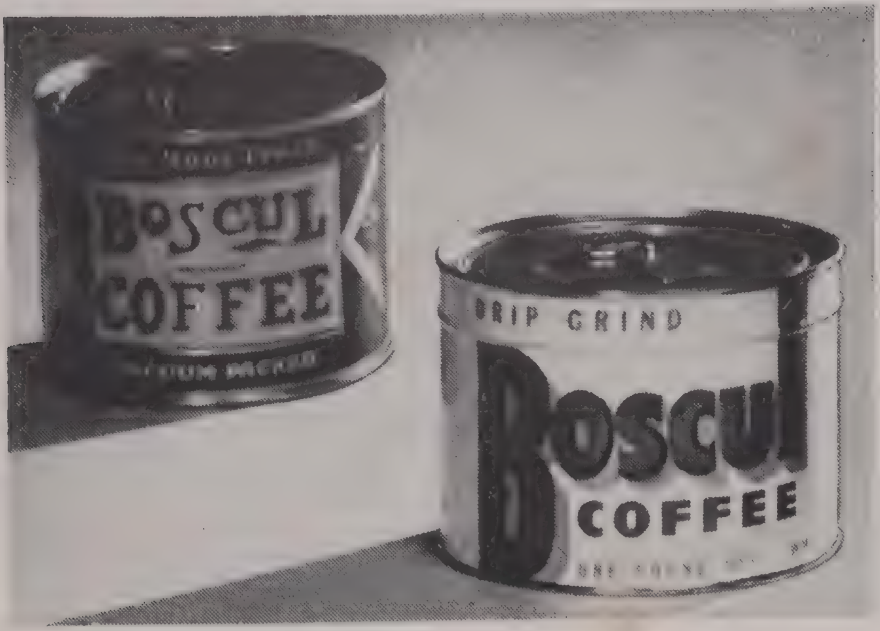
There has been, he recently stated, a spontaneous demand for remedial legislation—from forces which cannot be ignored. Furthermore, resolutions have been put before Congress which call for an investigation of the present chaotic situation and recommendations for such legislation.

Everyone will agree that the answers to this problem of chemicals in foods must be found, but it does not represent an emergency because it is not that acute. Therefore, it should be handled with great deliberation. If it isn't, much damage can be done by adopting measures which will hamstring or block scientific progress in agriculture and in food processing.

One does not envy food technologists, chemists and government officials the job that lies ahead of them. For, as Dr. Wilson expressed it: "One good hard-working chemist can create more problems than ten toxicologists can solve—and we don't have that many toxicologists."

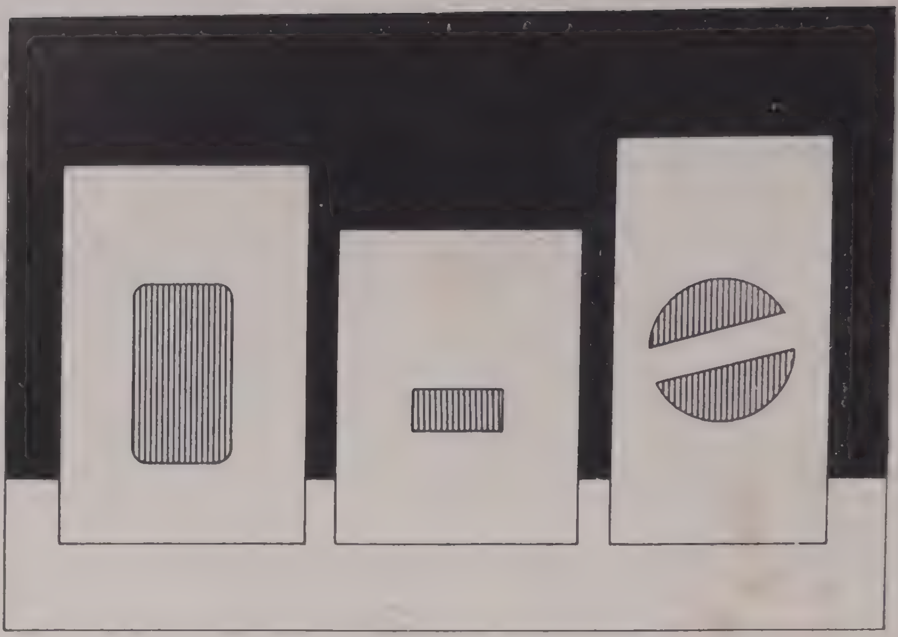
—**F. K. LAWLER**, ***Editor***

Check These Cardinal Factors ↓ →



Will a revamped label do it better?

Simplicity costs less, sells more—as in change from 5-color can (left) to new, attractive 3-color job (right).



Does that special feature really pay?

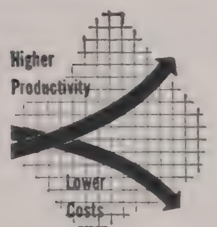
Scrutinize all "extras"—like these windows. They always add costs, don't always add enough sales to compensate.

Package Redesigning Can Save *Two* Ways

—First, by paring original packaging expenses. Second, by boosting sales, and thereby attaining new economies in the unit costs

JIM NASH

Package Designer, New York City



True enough, packaging costs have increased. But that's no reason why a processor should let his package expenses get beyond the bounds of good economics. Through proper redesigning, his costs can frequently be reduced and his package increased in effectiveness.

The Department of Commerce's latest quarterly Industry Report, *Containers & Packaging* says: "This industry (packaging) has expanded to such proportions that it is today one of the major basic industries in our national economy and makes a substantial contribution to the well-being of that economy."

Certain industries have flourishes of extravagance—in multi-color printing, expensive outerwraps, special shapes and sizes, and odd colors. And not infrequently, companies spend appreciable sums and yet secure very little value because proper planning and design have been neglected. Spending money this way involves waste due to failure to be effective. With pressure to reduce costs all along the line, the package designer can materially aid in effecting such reductions—while securing better results.

Cheapening of containers is false economy if the move results in decreased or static sales. But it is an economical achievement to increase sales by redesigning packages, while cutting costs or still maintaining the same costs. Actually, costs are lowered through increased sales. Naturally, the ideal is the double objective of reducing the original packaging costs and increasing sales into the bargain—thereby making a two-way cut in costs. From experience, we are convinced that this objective can be achieved by intelligent, planned package design.

As designers, our chief aim is to create the most effective design for a package at the least production cost.

Five Steps

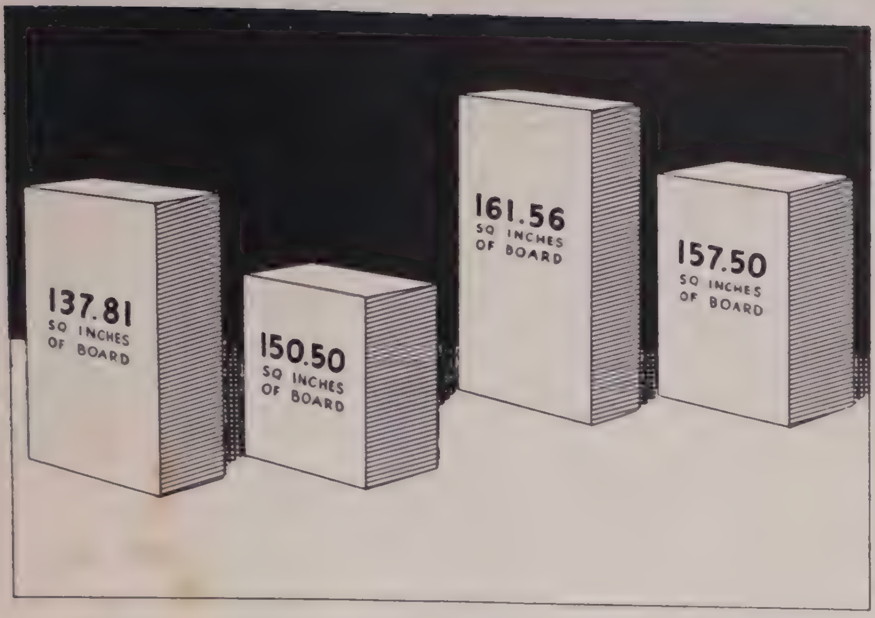
In going about a package-design, cost-reduction program, five aspects must be investigated: (1) Number and type of colors, (2) shape and style of package, (3) stock shapes, (4) unnecessary material costs, and (5) coordination of colors for combination runs.

Color is of value only in relation to its effective use. In too many cases, four and five colors have been used on the premise that many colors improve a package's appearance. But in most cases, the use of a multiplicity of colors is a waste of money. Unless the package design is well planned, colors—no matter what the number—will not make it appealing. Conversely, by using only three colors, the well-designed package can give the impression of more.

Another pet practice to which we commonly do not subscribe is the general use of special colors. However, we do employ them when the project specially warrants it and the cost is in keeping. Chief trouble with these colors is that they are difficult to maintain uniformly where presses run at high speed and where they must be printed on a variety of surfaces such as cellophane, parchment, Visking casings, coated label papers and cardboard.

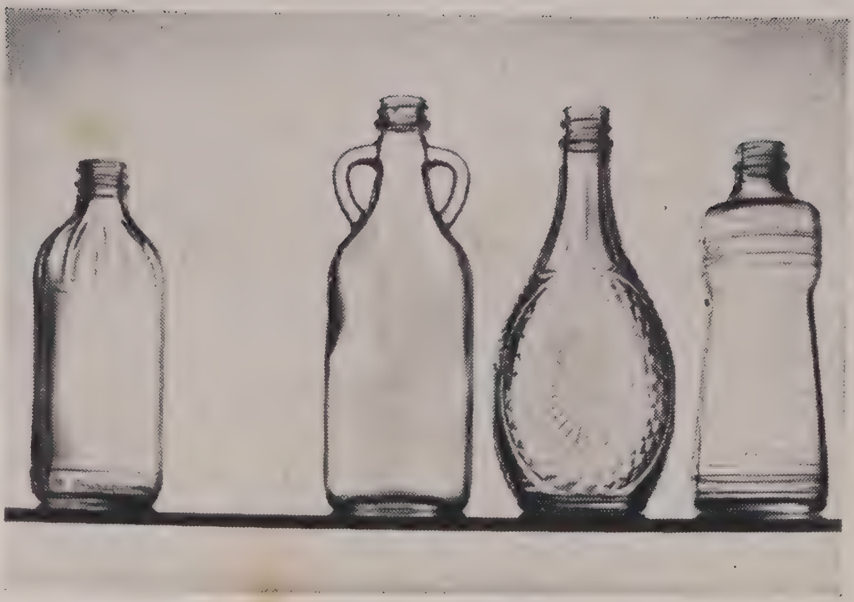
Again we say, if the design is not outstanding, all the colors that are odd or difficult to print will not make the package attractive. For instance, one of our clients printed his own labels. On every label there was a common color—blue. But not the same blue. For no good reason, this firm had adopted 14 different shades of blue. By reviewing this white elephant, which had grown without notice, we reduced the multiplicity of blues to 3 different shades, thus making a considerable saving in production costs.

Appetite appeal—actual illustration of the product—is generally good


137.81 SQ INCHES OF BOARD
150.50 SQ INCHES OF BOARD
161.56 SQ INCHES OF BOARD
157.50 SQ INCHES OF BOARD

Have I got more package than I need?

Boxes on market vary in paperboard used for same goods. Packages on left show savings of from 12 to 23 sq. in.



How about a thrifty standard container?

Individuality marks special bottles (right). Good labeling will individualize less costly standard bottle (left).

and sometimes essential. Certain products require pictorial illustration to explain them and their use. In any case, two questions must be considered: First, does the product lend itself to good reproduction? For it's notable that some do not. Second, is the reproduction appealing? For one without appeal or poorly reproduced is better omitted, since the cost of reproduction is totally lost. If the reproduction is good, an additional color (or colors) has generally been used to complete the design. However, additional colors are not always necessary.

By careful planning, we have made some full-color illustrations from the basic colors used in the background and design of a package. In most cases, a redesign job would eliminate the extra colors and at the same time increase the package's effectiveness.

Another color extravagance is found in those trademarks which depend on color for identity. It has always been our contention that a trademark should be unique in shape, so that a particular color is unnecessary to its value. Actually, we encourage our clients to use their trademark in differing colors. Let the shape be what the buyer recognizes and remembers. If given this uniqueness—shape—the designer can keep the number of colors to a minimum, consistent with well-planned design.

The final saving in color costs can be attained through greater use of the two free colors—white and the extra one obtained through overprinting two or more of the basic design colors. In too many cases, additional colors are introduced when an effective treatment can be achieved by using the free colors. And the cheapest color—white—frequently is poorly used.

Next, consideration should be given to the package itself. Some products have been introduced with tricky packaging. But when the problem of volume eventually arises, these products are generally forced into standard shapes and sizes. Today, there are undoubtedly many packages "still going" that were adopted when container board was cheap and little attention was given to saving money through relatively slight alterations of basic shape to cut down on square inches of board per package.

However, one must bear in mind optical size, shelf space, and display face, all of which are important when the product is competing in the store. Once a happy medium has been reached — a shape that uses the least board, yet assures adequate shelf display — the designer can select and arrange type, colors, pictures, wrappers and the like, to create the optical illusion of a different shape to make the package stand out. These board-saving compromises have been developed to the point where they are now almost standard formulas. What the competition does may influence the matter, but we feel that design can go far in meeting competitive factors.

> ■ **"Cheapening of containers is false economy if the move results in decreased or static sales. But it is an economical achievement to increase sales by redesigning packages, while cutting costs or still maintaining the same costs."**

In considering stock-shaped bottles and jars, which are no doubt the most economical, we believe the design of the label can be the dominant factor. Here, ingenuity of the designer can be put to the greatest use. Stock shapes have been developed to produce the greatest economy, and they are run continuously. A relatively small label can be designed for creating an illusion of difference. It is noticeable that many industries use metal-foil labels where protection was not required, or they have used metallic inks—both expensive processes. Others have tried to overcome "sameness" by using many colors. In both instances, one should investigate whether the results warrant the additional costs.

As designers, we believe competitive results can be obtained through simpler labels. Embellishment is not the answer. Character, brand identity, and directness and ease of consumer choice make the standard shape a seller, reducing costs at the same time. This can be done only through design.

Are Added Costs Justified?

In any study on reducing packaging costs, it should be determined whether all the various materials used are really needed—whether the benefits warrant the cost saleswise. For instance, one of our clients had a liking for putting a window in one of his cartons. Upon investigation, it was found that the cost would amount to many thousands of dollars per square inch per year. After figuring out how many square inches per package would be required, the project was dropped. We hasten to say that this is not an argument against window cartons. This was merely a specific case where costs and profits just did not work out.

With the free return of materials after wartime shortages, it is possible that the tendency to overdo got the upper hand. More colors, inner wraps, and outer wraps were used with cost no object. As more normal conditions

(*Turn to page* 196)

Promote Product A or B? Cut Output of Plant I or II? Here's Way to Right Answer

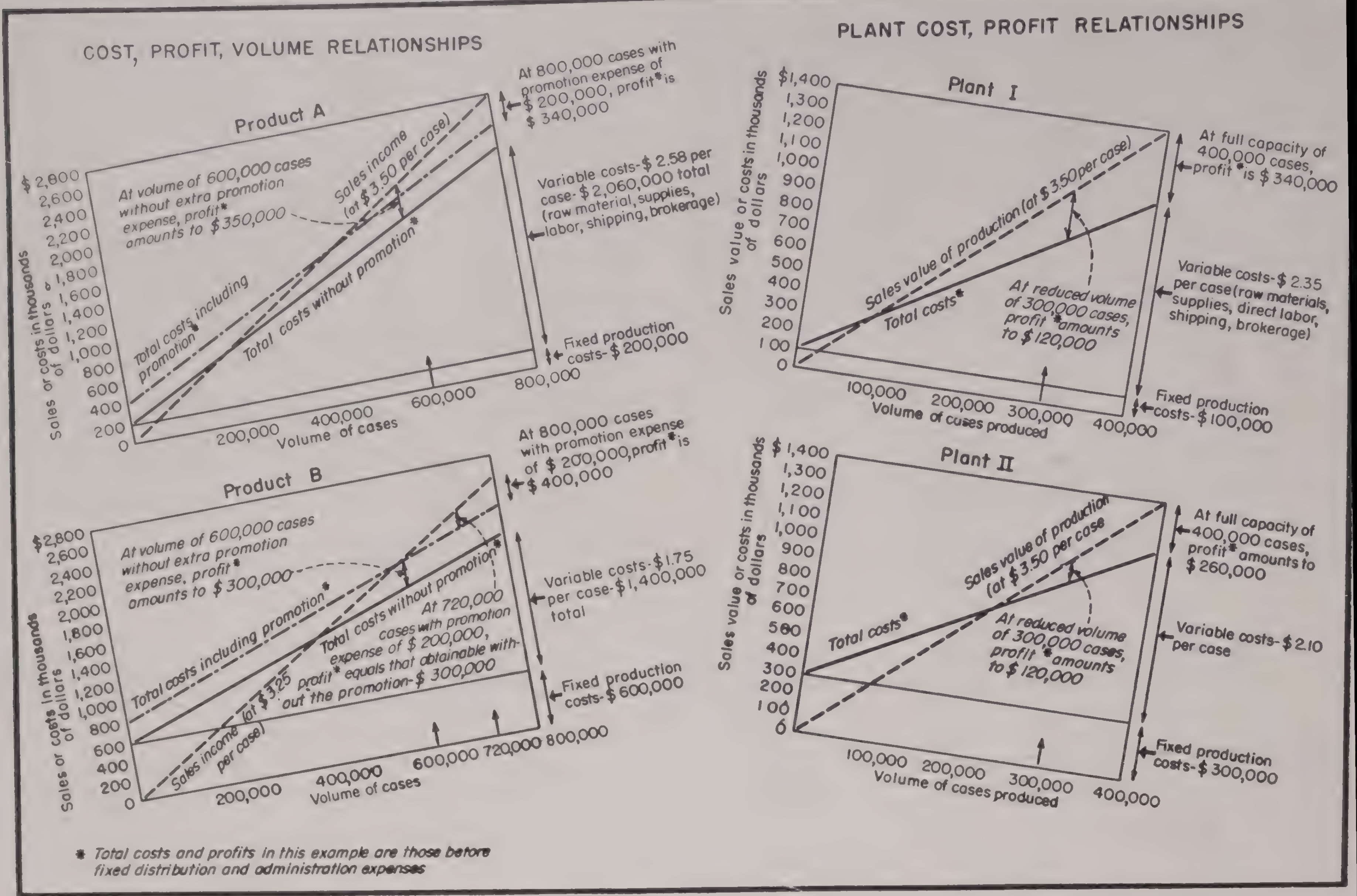
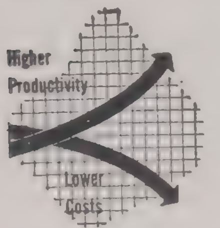


FIG. 1. TWO GRAPHS at left show cost-profit-volume relationship for two products, where promotion to increase sales of one or both is under consideration. Analysis indicates promotion is justified for Product B, but not for Product A. Graphs on right analyze cost-volume relationships in a two-plant operation, where one or both must be restricted to less than capacity production. Analysis shows why Plant II should be operated at full capacity, even though conventional cost sheet might indicate Plant I. It is the variable, not fixed costs, that make difference here.

Cut Pack Costs—With Planning Control

Fact is that conventional cost sheets can fool you—unless production plans have been developed right from top management down through plant foremen

DOUGLAS WATSON and KENNETH M. CUTHBERTSON
McKinsey & Co., Management Consultants, San Francisco



A minor revolution is occurring in the seasonal packing industry: The old idea that you do not control seasonal pack costs—that they just happen—is giving way. Cost consciousness and cost control are increasingly important elements in the successful production manager's operations.

For the past ten years, the plant manager has almost exclusively devoted his efforts to the physical aspects of processing the seasonal receipts of fruits and vegetables—cost has been less important. The lack of manpower, shortage of cans and glass and sugar, and extremely heavy demands for finished goods upset the normal balance between cost, quality and production. Cost, and in some cases quality, have suffered in the effort to maximize production. But large carry-overs of finished goods and increasing consumer price resistance are forcing high quality production at low cost these days.

Planned Control

Low cost production does not merely happen. It is the result of intensive planning and control from top management right down to and including the plant foremen.

Sound cost and production plans must be made in three basic organization areas, and adequate control must follow the planning. These areas are:

1. *Profit planning by top management:* This top-level phase of planning involves both sales and production. Essentially, it requires estimating costs at various volume levels and comparing these costs with forecasted prices at several sales volumes. As a result of this step, the over-all pack plans are developed and product quantities for each grade are determined. This sets up the "battle plan" for the sales year. The plan then goes to production management for further detailing.

2. *Pack campaign planning by production management:* In those companies with multi-plant operations, this

is a most important cost planning step. Using the basic sales plan as a guide, production management, with the cooperation of the plant managers, determines the availability of raw material, the ability of the separate plants to produce at low and competitive cost, and the time when the goods are to be produced in terms of the demand for the finished product.

3. Operation planning and control by plant management: Once the pack campaigns have been determined, the low cost preparation of finished goods in final form for the consumer becomes a plant problem.

Plant plans are made on a current day-to-day basis in contrast to the profit and campaign plans, which are made before the pack is underway. To maximize his profits, the plant superintendent must make decisions on the spot as the season progresses. He bases these decisions on knowledge of how his costs are affected by variations in quantity and quality of incoming raw materials and ingredients, the availability of labor, and by the quality and quantity of finished goods he must produce.

All of these planning steps must be taken if the final product is to be produced at lowest cost and seasonal plant costs are to be controlled.

Profit Planning

Cost control begins with top management. Costs and cost limits play an important part in planning the year's sales and operations. They are matched against demand to establish the relative profit opportunities of alternative programs. This is all part of setting a company's annual profit objective by means of an over-all plan.

Three major steps lead to establishing a tentative master profit plan. First, a forecast of product sales prices and volume; second, a forecast of production cost elements, and third, a comparison of sales and costs to develop a plan with the maximum profit potential.

The sales forecast is obviously the starting point in over-all planning. Coupled with carry-over information, it will set the limits of the production program. Sales forecasting, which is not the subject of this article, will consider such matters as general economic conditions and trends, company position in the industry, and special promotional efforts. It may well result in several forecasts of volume depending upon the estimated price levels. These varying estimates can be compared with costs expected to result from the related production volumes.

Forecasts for production cost elements are concerned mainly with raw material and labor. Standards of usage for raw product and labor should be available in terms of physical units such as pounds per case or hours per case. These standards can be converted to estimated costs only after an analysis of what crop prices and hourly labor rates are likely to be.

The third step—comparing sales and cost opportunities—uses the forecast data to establish a sales and production plan that will produce the greatest profit. When the management selects the most profitable operating plan, the cost bases used in setting the plan become the cost goals that production management must endeavor to meet during the year.

Important Cost-Volume Relationships

This third step is a most critical one. In the seasonal packing industry, it is particularly important to recognize how cost-volume relationships affect profits. The industry incurs many production costs, which are fixed for the year even though the packing season may be only a small part of the year. Such costs as plant supervision, key men, equipment depreciation, maintenance and occupancy are examples.

The relative amount of these fixed costs may vary for different products. Some may require more expensive plants and machinery, with possibly lower labor costs. Too often the significance of fixed costs and the cost-volume relationship is neglected in the analysis of product profitability. A somewhat simplified example will illustrate the type of planning approach that recognizes these cost factors.

Company X packs several products. Sales forecasts indicate that with a special promotional effort costing $200,000 the sales of *either* Product A or Product B could be boosted 200,000 cases at the same sales price. Management seeks to determine whether the promotional effort is worthwhile and which product should be pushed. Without the extra promotion, sales of each are expected to be 600,000 cases, which equals the past year's results. The following schedule shows Company X's profit potential if the $200,000 is not spent for promotion:

	Product A	**Product B**
Volume	600,000 cases	600,000 cases
Sales price per case	$3.50	$3.25
Sales	$2,100,000	$1,950,000
Fixed production costs	200,000	600,000
Variable production and distribution costs.	1,550,000	1,050,000
Total costs before fixed distribution & administrative expenses	$1,750,000	$1,650,000
Profit before fixed distribution & administrative expenses	$350,000	$300,000
Percentage of sales	16.7%	15.4%

Fixed production costs include those annual plant expenses, the total of which will not vary due to volume during the packing season. Product B carries relatively higher fixed costs because it is more susceptible to mechanized operations, requiring large capital investments.

Variable production and distribution costs include raw material, packaging and other supplies, labor, shipping and sales brokerage. These amount to $2.58 per case for Product A and $1.75 per case for Product B. The *per-case* amount of these variable costs remains practically constant; the *total amount* of these costs therefore varies

To Sort Or Not To Sort—This Curve Will Tell

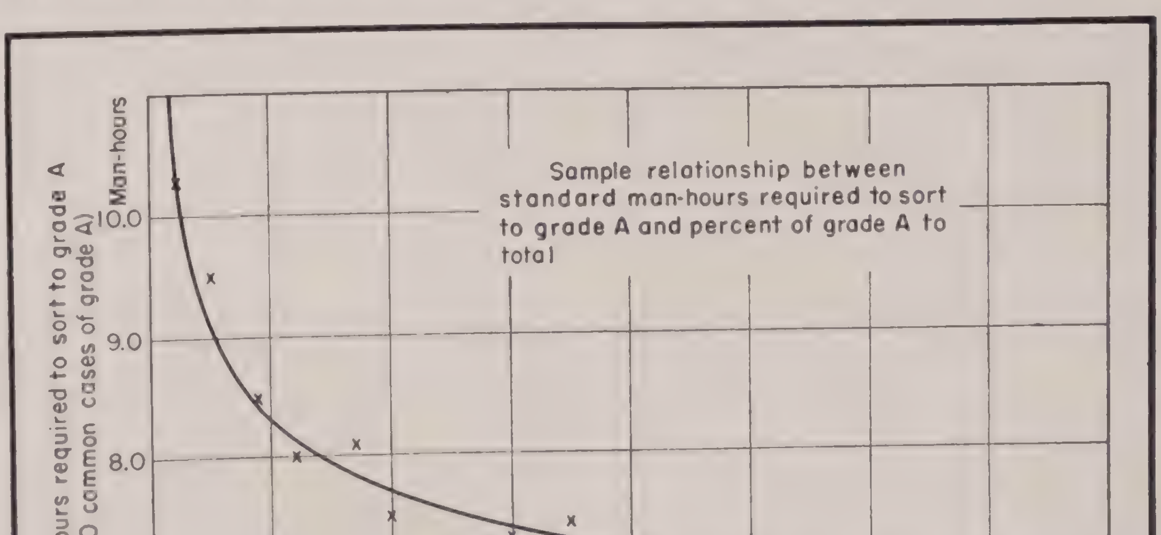


FIG. 2. AFTER sampling has determined approximate grade mix, a chart of this kind can tell you if sorting out higher grade material will pay off.

directly with volume. The "profit" figure shown is really the contribution which each product makes to cover fixed selling and administrative expenses and to provide ultimate net profit.

As shown in the above schedule, Product A carries the higher sales price per unit. At last year's volume, it returns a greater dollar profit and a greater profit as a percentage of sales. A decision as to which product should have the extra promotion might be made in favor of Product A if the analyses were based on conventional operating statements, which do not clearly separate fixed and variable costs.

Because of the existing cost-volume relationships, however, Product B is the one whose volume should be increased. The following table shows, for each product, the effect of the increased volume on profits resulting from the additional promotion:

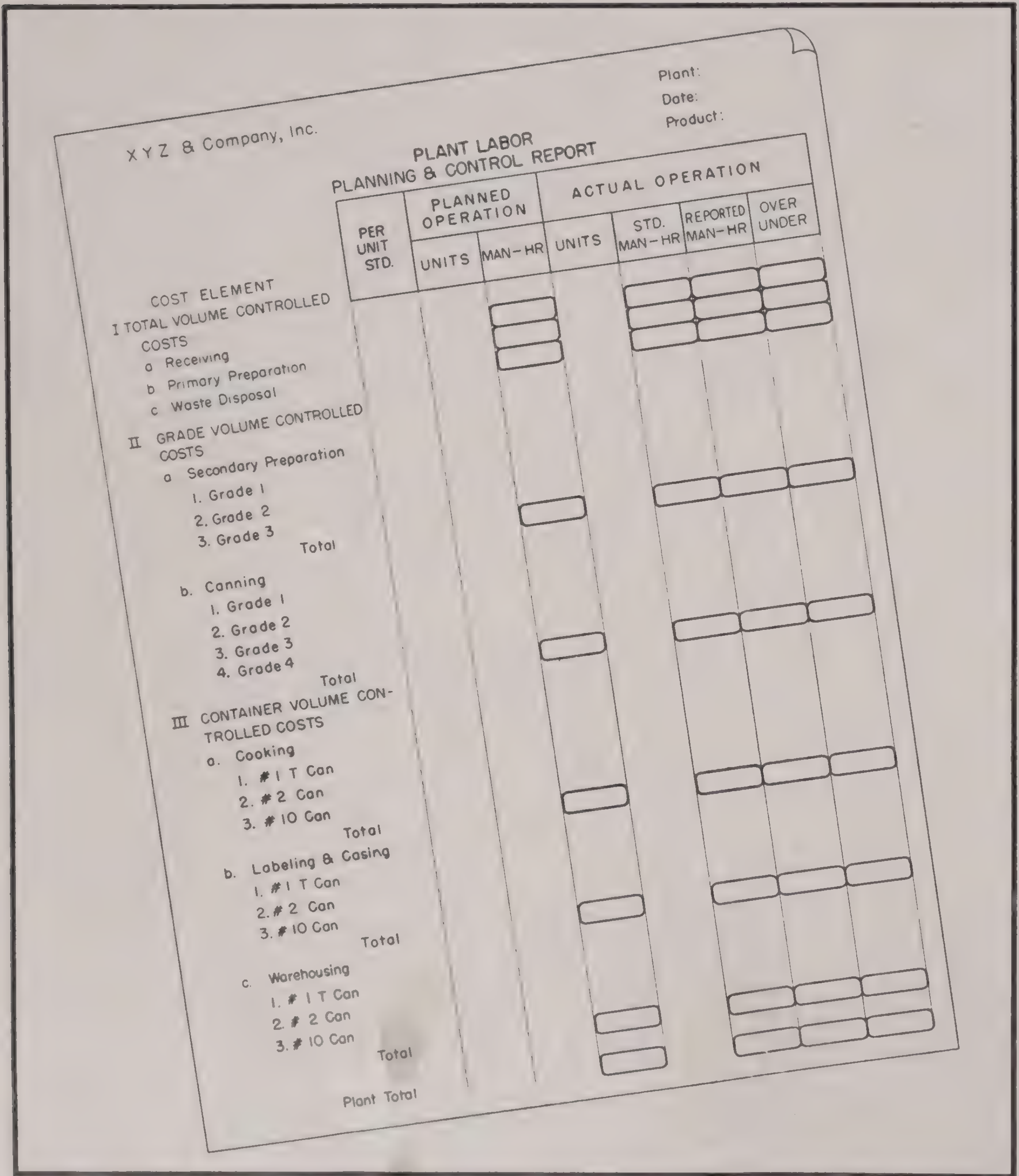
	Product A	**Product B**
Volume	800,000 cases	800,000 cases
Sales price per case	$3.50	$3.25
Sales	$2,800,000	$2,600,000
Fixed prod. costs	200,000	600,000
Variable prod. and dist. costs	2,060,000	1,400,000
Cost of additional promotion ...	200,000	200,000
Total costs & administrative expenses	$2,460,000	$2,200,000
Profit before dist. and admin. expenses	$340,000	$400,000
Percentage of sales	12.1%	15.4%

This indicates that the increased promotion and volume for Product A would result in $10,000 less profit than before. It is worthwhile, however, for Product B, and would increase profits $100,000.

The cost-profit-volume relationships involved in this analysis are shown in the upper part of Fig. 1. Graphic presentation is desirable in analyses of this type because it makes cost and profit situations at various volumes readily observable.

In this example, the curves for Product B show the added promotion expense to be worthwhile at a volume of 720,000 cases. At that point, "profit" is $300,000, or equal to the "profit" obtainable at the 600,000 case volume without the additional promotion expense. expense will yield additional profits if it increases volume by more than 120,000 cases. Since our Company X example shows a potential increase of 200,000 cases, it definitely is desirable.

Form Pins Down Volume and Labor Aberrations



XYZ & Company, Inc.

Plant:
Date:
Product:

PLANT LABOR PLANNING & CONTROL REPORT

COST ELEMENT	PER UNIT STD.	PLANNED OPERATION UNITS	PLANNED OPERATION MAN-HR	ACTUAL OPERATION UNITS	ACTUAL OPERATION STD. MAN-HR	ACTUAL OPERATION REPORTED MAN-HR	ACTUAL OPERATION OVER UNDER
I TOTAL VOLUME CONTROLLED COSTS							
a Receiving							
b Primary Preparation							
c Waste Disposal							
II GRADE VOLUME CONTROLLED COSTS							
a Secondary Preparation							
1. Grade 1							
2. Grade 2							
3. Grade 3							
Total							
b. Canning							
1. Grade 1							
2. Grade 2							
3. Grade 3							
4. Grade 4							
Total							
III CONTAINER VOLUME CONTROLLED COSTS							
a. Cooking							
1. #1 T Can							
2. #2 Can							
3. #10 Can							
Total							
b. Labeling & Casing							
1. #1 T Can							
2. #2 Can							
3. #10 Can							
Total							
c. Warehousing							
1. #1 T Can							
2. #2 Can							
3. #10 Can							
Total							
Plant Total							

FIG. 3. HERE is one way to combine labor cost control report with daily planning report to identify and isolate two variables—volume and efficiency.

This example merely illustrates the cost-volume approach to one problem. It can and should be used throughout profit planning, which eventually leads to an over-all plan for the year. This resulting plan, which establishes production volume and cost goals for all products, is then referred to production management for more detailed planning.

Pack Campaign Planning

This stage of forward cost planning is of great importance in companies with multi-plant operations. Using the tentative over-all sales plan, production management must determine where each product is to be packed. In the seasonal packing industry, this problem is complicated by overlapping product seasons. The planning problem is one of analyzing the many alternatives in order to achieve lowest costs and maximum profits.

Production management needs additional detailed information—considerably more than that used in the over-all sales planning. The timing of crop maturities is essential in scheduling plants for the various products. The location of raw materials sources and finished goods markets affects transportation costs to and from the various plants. Finally, knowledge of the cost performance at individual plants is also essential to effective campaign planning.

Generally, this last type of information has not been available in sufficient detail. Plant cost performance must be built up in terms of the standards and the adequate classifications discussed later in this article.

Here again, cost performance data sholud be arranged to allow analysis of the cost-volume relationships. Individual plant fixed costs can be a major consideration in the selection of plants for specific products. An illustration may be helpful:

Company Z has developed an over-all sales plan calling for 700,000 cases of Product C. The product can be packed at Plants I and II. Each has a normal capacity of 400,000 cases for this product during the expected eight-week season. The over-all sales plan does not require the 100,000-case excess capacity. Therefore, production management must decide which plant is to operate below capacity. In the past, both plants operated at full capacity for Product C. Although Plant I has shown a higher labor cost per case, it has been the most profitable, due to lower fixed costs.

Cost performance data indicate that *at full capacity,* as in the past, the following results could be expected at each plant for Product C:

	Plant I	**Plant II**
Sales value of prod., 400,000 cases at $3.50 per case	$1,400,000	$1,400,000
Fixed prod. costs (allocable to 8-week season).	100,000	300,000
Variable prod. & dist. costs....	940,000*	840,000**
Total of these costs	$1,040,000	$1,140,000
Profit before fixed dist. and admin. expenses	$360,000	$260,000
As a percentage of sales value.	25.7%	18.6%

* @ $2.35 per case. ** @ $2.10 per case.

The lower variable costs at Plant II result from a lower labor cost per case and lower freight costs because of better location with respect to raw materials and markets. Plant II's higher fixed costs are due to large investment in improved buildings and mechanical processing equipment.

With a conventional classification of costs, it is likely that Plant I's higher rate of profit would indicate that it should be assigned to full capacity and Plant II's volume reduced. The breakdown above, however, accents the fact that differences in fixed costs make a cost-volume analysis essential.

Production management should have cost performance data for Product C at Plants I and II in the graphic form shown. These charts, based on predicted costs for the coming season, show how a reduction of volume at either plant will affect total costs and profits. In this way, the best production schedule to fit into the campaign can be selected.

Analysis of the plant graphs in Fig. 1, shows that Plant II should be scheduled to full capacity and Plant I's volume reduced 100,000 cases. This combination would produce profits (before fixed distribution and administrative expenses) of $245,000 at Plant I and $260,000 at Plant II—a total of $505,000. The alternative of reducing Plant II's volume 100,000 cases and running Plant I at full capacity would result in profit figures of $360,000 at Plant I and $120,000 at Plant II—a total of $480,000. The correct decision in this case can mean a difference of $25,000 in profits for this one product alone.

Campaign planning problems are seldom as simple or isolated as the one just outlined. But the approach illustrated can be applied to the more complex situations. With a knowledge of the cost-volume relationships for each product at each appropriate plant, management can weigh alternative production plans to achieve the greatest over-all profit.

This type of planning is really cost control at a high level. Control is achieved by taking every opportunity to select, in advance, the lowest cost campaign plan. These costs then become the operating cost goals for each plant during the season.

Both the over-all sales plan and the production campaign plan need to be flexible, since they may be subject to revision during the year. Changes may occur in market prices or in cost elements such as raw material or labor. The tentative sales and production plans must be re-studied in the light of such changes. As plans are revised, the new objectives should be relayed to plant managers so that these men are at all times informed of their production volume and cost goals.

Operations Planning and Control

Adequate profit and campaign planning require advance determination of fixed and variable costs. Plant planning and control have the same requirement. How can these costs be predicted?

The fixed costs for the plant are relatively easy to determine, because they are not ordinarily subject to wide variation from year to year. Reference to historical data modified by any recent changes will form the basis for budgets of the fixed expenses. Since these costs do not fluctuate frequently, they can be controlled by means of monthly comparisons of actual cost versus the budget or planned amounts.

The variable plant costs are subject to much greater and more frequent fluctuation. Therefore, they must not only be forecast with accuracy but must be checked much more frequently than fixed costs in order to achieve adequate control.

These variable costs are not only markedly affected by the variations in production level or product mix, but are also substantially changed by variations in ingredient and supply prices, maintenance part costs, and labor rates. For this reason, the simpler budgeting technic used for forecasting fixed costs must be modified for these variable costs.

As a first step in establishing standards for variable costs, operations should be analyzed on a step-by-step basis. This analysis should result in the determination of cost centers. If control is to work well, each cost center should be under the complete responsibility of a foreman or supervisor so that he can be held completely accountable for results of that particular operation. Furthermore, these centers should be so established that their costs can be added together in various combinations to obtain total available costs for any given process.

For effective variable cost forecasting, standards should be developed in terms of physical units, such as man-hours for labor, pounds for raw material and ingredients, and units for containers. Some of these standards are relatively easy to determine, such as time per ton required for receiving fruit, or the amount of sugar to be used per case of peaches of a specified syrup content.

Other operations, such as grade sorting, canning, and certain cookroom activities, are more complex. In these cases, the standards are somewhat more difficult to establish. There are, however, technics that can be used to determine how much time is involved in these activities.

For example, in Fig. 2 a typical relationship between grade sorting, man-hours and volume has been determined. This information, developed from time studies of a sorting operation, is expressed in terms of man-hours so that sorting costs can be predetermined once the labor rate is known and the grade mix approximated. Similar time standards can be developed for many of the important process steps and used not only to predetermine plant costs, but also to plan for current plant operations and to control plant results.

Standards for Planning and Control

Control information by itself is of no value unless it is put to work. The facts developed under a program such as this can be used by the plant manager for two important portions of his job: Daily operations *planning,* and current operations *control.*

The good plant manager not only plans the work to be done tomorrow, but also constantly evaluates the work that was done yesterday and is being done today. This aspect of control is the follow-up on the plan, and it serves as a basis for modifying the basic production program to achieve the lowest over-all cost.

Daily Operations Planning

With the facts available as to the quantity and quality of material to be received using these standards, the plant manager can very quickly establish sound operating plans.

Since most seasonal packing operations are of the "process" type, it is relatively simple to work out the form that these daily operations plans should take. The amount of detail required to set up this type of plan can be held to a minimum. It is of a simple nature and can be absorbed into the normal office routine without much difficulty.

This Plant Labor Planning and Control Report, developed at XYZ & Co. is made available to the plant manager on a daily basis. It compares the man-hours actually used with those called

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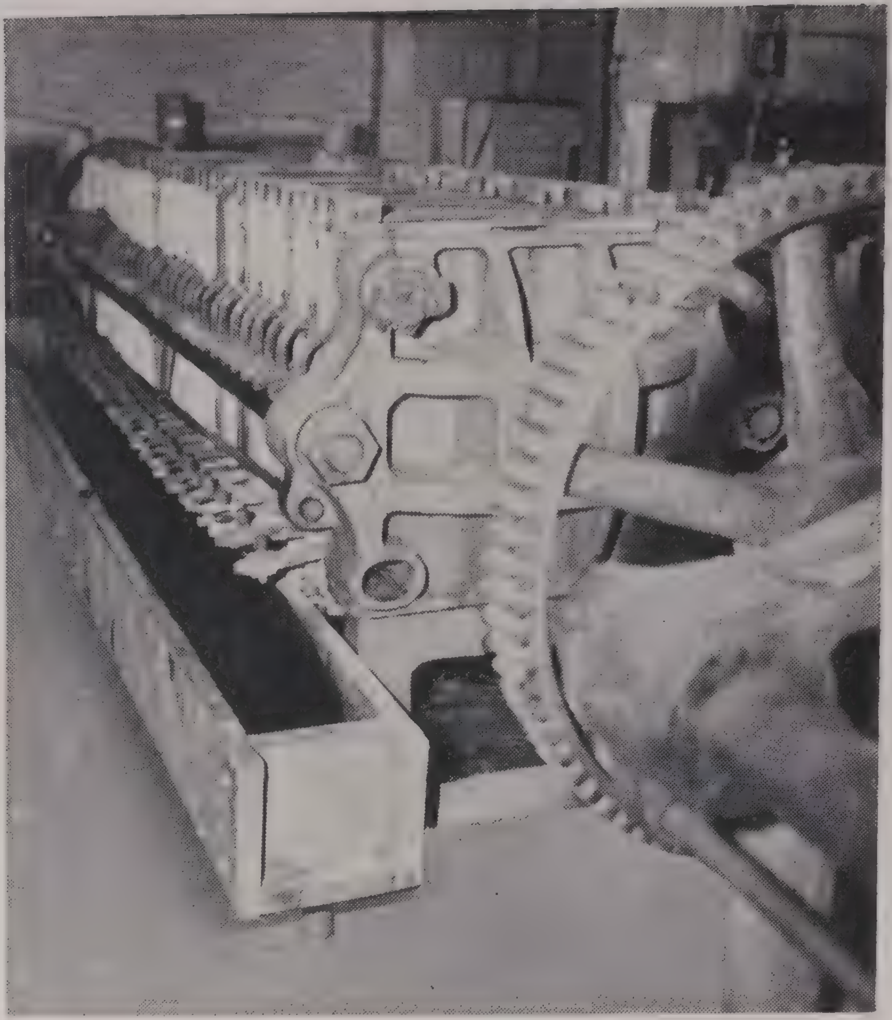
Photo-brief of vinegar-purging method →

1 IN 30,000-gal.-tank lots, vinegar is treated with calcium phytate to precipitate copper and iron salts.



2 FILTRATION removes precipitated phytates. Result: vinegar with only 2.5 ppm. iron and less copper content.

Takes Heavy Metals Out of Acid Foods

New method uses calcium and sodium phytate to precipitate iron and copper from vinegar, points way to further successes in removal of metallic traces

R. F. COHEE, JR., and GEORGE STEFFEN
Corn Products Sales Co., and M. Steffen & Co., Chicago, respectively

As a result of a new method for refining vinegar, attractive possibilities are now seen for use of chemical precipitation and filtration for quantitative removal of heavy trace metals from acid liquid foods and materials used in connection with food processing.

This method includes employment of sodium or calcium phytate to take out copper and iron as insoluble phytates from both white distilled and cider vinegars.

The possible effectiveness of sodium or calcium phytates for the removal of other metals is yet to be determined. But, it is known that sodium phytate in water solutions reacts with soluble salts of many metals to give practical quantitative yields of the corresponding insoluble phytates—metals of the alkali series excepted.

Among the relatively large number of other known insoluble phytates are those of aluminum, barium, beryllium, cadmium, chromium, cobalt, lead, magnesium, mercury, nickel, silver, tin and zinc. Several of these are of interest in food processing, particularly where there is aid in the removal of trace metal "trouble makers". However, more studies must still be made to determine their order of solubility under the various conditions encountered in processed foods—especially under different concentrations of acidity.

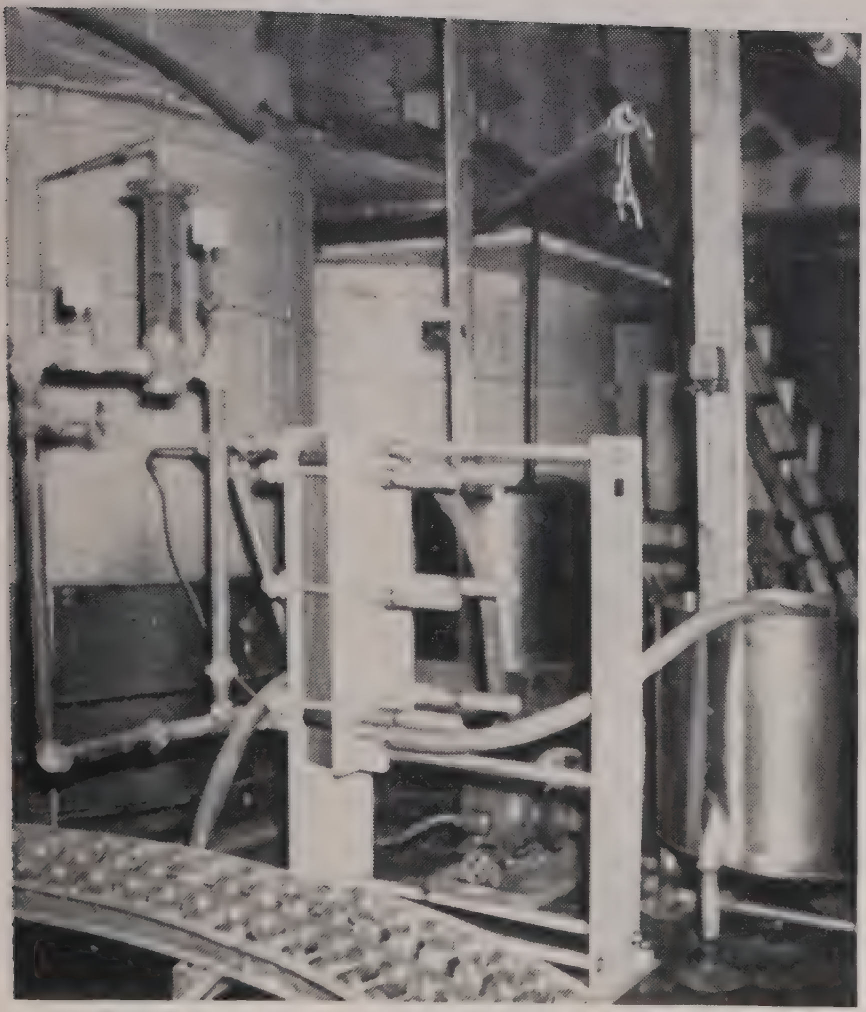
Out of Necessity

The application of the phytate method to the treatment of vinegar was, in a way, the old story of necessity being the mother of invention. To a great extent, it was the result of the senior author's recalling that iron phytate, because of its insolubility, had been discarded as an enriching form of iron for white flour and bakery products.

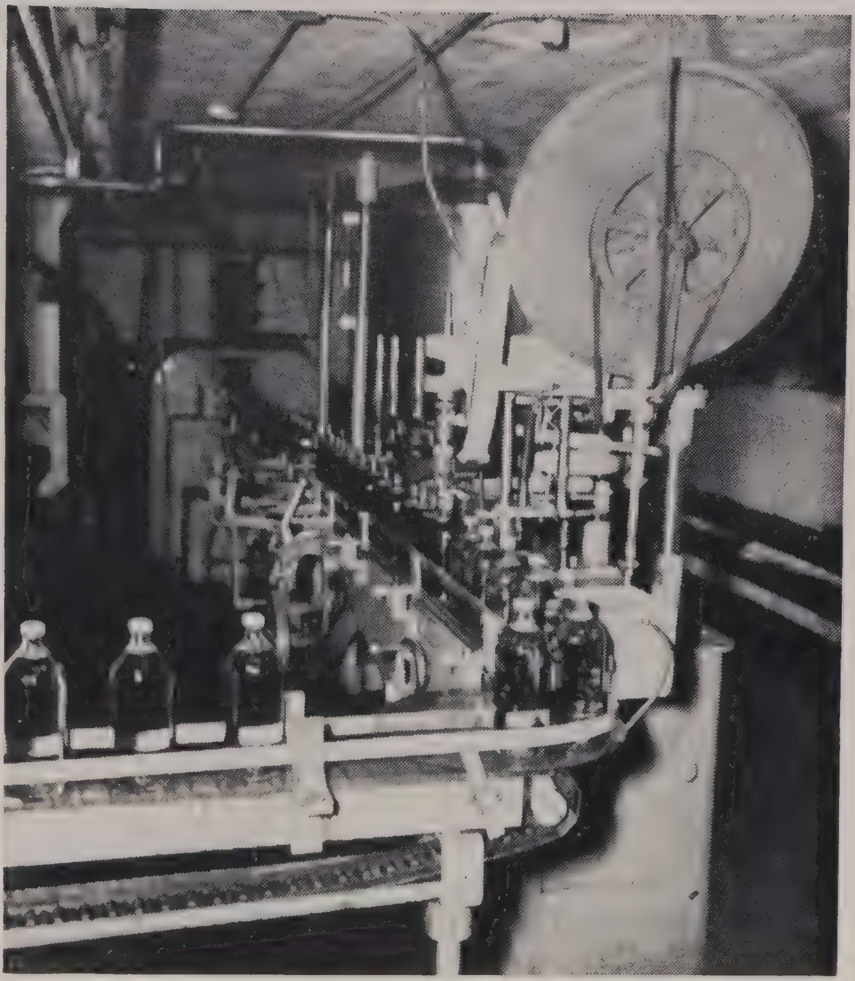
Here is how it all came about: Early in October 1948, a large quantity of cider vinegar had been found to be too high in iron salts to be bottled without danger of haze, discoloration and precipitation. The iron content of this vinegar was found to be in the range of from 25-30 ppm. Previous experience had indicated that 10 ppm. of iron sometimes proved troublesome in vinegar and that the standard on cider vinegar should be below 8 ppm.

Clarification with gelatin and tannin had been tried unsuccessfully. Activated carbon had removed about half of the iron content—but it also removed the color from cider vinegar. Bentonite-casein clarification, as suggested by Saywell[1], was also tried; however, it left a too-high iron content. Use of potassium ferrocyanide fining was, of course, a possible metal-removing procedure, but this was considered extremely unsuitable for several reasons.

In addition, the use of various ion-exchange resins was thoroughly explored. And two types were found to remove iron and copper. Yet, a simpler and less expensive method



3 **PASTEURIZATION** prevents microbe-caused cloudiness. It also improves the color of the vinegar.



4 **CRYSTAL CLEAR** vinegar goes into bottles, which protect product against subsequent contamination.

was needed. Preliminary calculations showed that the iron content of commercial bottled vinegar could be reduced to under 3 ppm.—if the proper procedure was followed to precipitate the iron as phytate.

Method With Vinegar

Briefly, the method for vinegar consists in adding the proper amount of calcium or sodium phytate to react with the iron and copper salts present. As an example, 1.25 lb. of calcium phytate added to 1,000 gal. of vinegar containing 25 ppm. of iron and then heated to about 180 deg. F. causes precipitation of the iron. This procedure reduces the iron content to about 2.5 ppm. after filtration. At the same time, the copper content is also markedly reduced.

It should be added that the addition of phytates to vinegar caused a cloudy flocculation, which was easily filtered out in laboratory as well as in the plant-scale operations.

In Table I is given the amount of calcium phytate to add to 1,000 gal. of vinegar of definitely known iron content. Roughly speaking, about the same amount is necessary to remove equal ppm. of copper. Plenty of time for storage of the vinegar should be available so the reaction can go to completion.

Although sodium phytate might have been used, the cheaper salt, calcium phytate, was chosen for this experimental work. This chemical deserves serious consideration as a means of overcoming difficulties due to the presence of trace metals which are less soluble as phytates than in the form of other salts in similar acid media. Calcium phytate solubility in dilute organic acids is sufficient to make it effective as a heavy metal remover.

Calcium phytate was found to be soluble in 5 percent acetic acid or 50-grain cider vinegar to the extent of about 0.5g. per 100cc., which is equivalent to 5g. in a liter. This solubility is greater by far than that needed to treat any vinegars or other materials so far studied.

One of the biggest objections to the general use of calcium phytate is that its commercial form is contaminated with iron. However, in the case of vinegar, this objection is easily overcome because a waiting period is possible in which an almost total precipitation of all iron present can be obtained before the vinegar is used.

Calcium Phytate Cheaper

During the course of the tests in the laboratory, practically iron-free sodium phytate was used, and the time element was not a factor with its use. The relative prices of sodium and calcium phytate decidedly favor the use of calcium phytate for use in vinegar, even when a 30,000-gal. tank of vinegar might be treated. The reaction can be speeded up by heat. Also, a two-weeks' waiting period was found to be sufficient to reduce the iron content to a relatively low level on a commercial scale. Indication of the relative time taken to remove the iron from cider vinegar is found in Table II.

Disclosed in Table III are the results of treating a badly contaminated white distilled vinegar with successive portions of calcium phytate. These results indicate, as other data had shown, that copper is harder to precipitate as a phytate than is iron. After three days of successive additions and heatings to 180 deg. F., the copper was reduced to 20 ppm. and was still precipitating slowly. Thus, it appears that copper phytate under the acidic conditions of vinegar is more soluble than iron phytate or, at least, is held in solution much better.

In order to arrive at a rough idea of the quantitative relationships involved, a cider vinegar high in iron and copper was treated with three different quantities of both calcium and sodium phytate, as indicated in Table IV. These various combinations were heated to 180 deg. F. Then, the precipitate was allowed to flocculate and settle, and the residue was collected and weighed. After the filtrates had set for a week, more precipitate formed, was filtered out, and was also weighed. The ashed residues indicated that the iron and copper were being removed in the precipitates. The data in Table IV indicate the almost quantitative relationships found when either calcium or sodium phytate is added to a vinegar high in iron and copper.

Heating the mixture of calcium phytate and vinegar to 180 deg. F. speeded up the reaction considerably. Heating is feasible in most vinegar plants, since the necessary heat exchangers are easily available. Table V gives the results of analyses on several treated vinegars from different sources. They were heated after adding the calcium phytate, held to permit the precipitate to settle or develop, filtered, and analyzed at various intervals.

In some vinegars, the addition of calcium phytate had a tendency to reduce the amount of color. The cloudiness developed by the flocculent precipitate seemed to carry down part of the coloring matters in the vinegar. For this reason, the tannin and coloring values on several vinegars were determined before and after treatment. Also, the colors of the vinegars before and after treatment were measured, using the Nissen[2] method. In Table VI are given the color and tannin levels before and after treatment of vinegar with calcium phytate.

Table VI data shows that care must be exercised—for a cider vinegar too light in color may result if the vinegar is not handled properly. This likelihood is an additional argument for heating, which helps to add color to the vinegar. The reason for this is that the iron phytate formed by the addition of the calcium phytate to vinegar is so insoluble that it apparently carries the ferric tannin complexes down with it in some cases.

Other Possibilities

In order to investigate the possibility of removing other trace metals—such as copper and lead—sometimes occur-

(*Turn to page* 199)

Tables Tell Story: Phytates + "Traces" In Vinegar = Metal Precipitates

TABLE I—AMOUNT OF CALCIUM PHYTATE to Add to a Vinegar of Definite Iron Content

Iron In PPM.	Grams Calcium Phytate for 1 Liter	Grams Ferric Phytate Expected from 1 Liter	Grams Calcium Phytate Needed for 1,000 Gal.	Pounds and Ounces of Calcium Phytate Needed for 1,000 Gal.
5	0.02	0.0194	75.7	2.67 oz.
10	0.04	0.0388	151.1	5.34 oz.
15	0.06	0.0582	227.1	8.01 oz.
20	0.08	0.0776	302.8	10.68 oz.
25	0.10	0.0970	378.5	13.35 oz.
30	0.12	0.1164	454.2	1 lb. 0.02 oz.
35	0.14	0.1358	529.9	1 lb. 2.69 oz.
40	0.16	0.1552	605.7	1 lb. 5.36 oz.
50	0.20	0.1940	757.0	1 lb. 10.70 oz.
60	0.24	0.2328	908.4	2 lb. 0.04 oz.
75	0.30	0.2910	1135.0	2 lb. 8.05 oz.
100	0.40	0.3880	1514.0	3 lb. 5.40 oz.

TABLE II—PROGRESS of Large Scale Treatments of Cider Vinegar With Calcium Phytate (no heat)

		Iron Content And Percent Removed		
Date	Chronology of Tests	Tank No. 6	Tank No. 9	Tank No. 14
5-21-49	Iron content before treatment, ppm.	25.0	25.0	25.0
5-26-49	Iron 5 days after treatment, ppm.	12.0	7.0	12.0
	Iron removed, %	52.0	72.0	52.0
6-3-49	Iron 14 days after treatment, ppm.	3.0	4.0	3.0
	Iron removed, %	88.0	84.0	88.0
8-23-49	Iron at time of bottling vinegar, ppm.	2.5	2.5	2.5
	Iron removed, %	90.0	90.0	90.0

TABLE III—RELATIVE RATE of Iron and Copper Removal From a White Distilled Vinegar

			White Vinegar		
Date	Treatment	Appearance	Iron ppm.	Copper ppm.	Remarks
8-26-49	None (start)		40	60	
8-26-49	0.1g. calcium phytate/100 c.c. Heat to 180 deg. F., let stand 15 min., filter	Heavy ppt.	12	30	Neither ppt. complete
8-26-49	0.1g. calcium phytate/100 c.c. Heat to 180 deg. F., let stand min., filter	Heavy ppt.	3	25	
8-28-49	0.1g. calcium phytate/100 c.c. Heat to 180 deg. F., let stand until 8-28-49	ppt.	1	20	Iron ppt. complete. Copper still precipitating

TABLE IV—QUANTITATIVE RELATIONSHIPS of Calcium and Sodium Phytates in a High Iron and Copper Cider Vinegar Heated to 180 F. After Addition of Phytates

Date	Relationships	Control	Calcium Phytate			Sodium Phytate		
7-23-49	Grams of phytates added to 450 c.c. vinegar	0.0	0.0625	0.1250	0.1940	0.0625	0.1250	0.1940
7-23-49	Grams of 1st precipitate	....	0.0435	0.0684	0.0773	0.0403	0.0642	0.0612
7-30-49	Grams of 2nd precipitate	....	0.0363	0.0248	0.0356	0.0391	0.0317	0.0343
....	Grams of combined precipitates	....	0.0798	0.0932	0.1129	0.0794	0.0959	0.0955
....	Expected iron phytate at 22.5 ppm	....	0.0382	0.0382	0.0382	0.0382	0.0382	0.0382
....	Expected copper phytate at 31.5 ppm. ½ Cu.++½ Cu.+	....	0.0551	0.0551	0.0551	0.0551	0.0551	0.0551
....	Total of expected iron+copper phytates	....	0.0933	0.0933	0.0933	0.0933	0.0933	0.0933
....	Wt. of combined residue as mixed phytates	....	0.0798	0.0932	0.1129	0.0794	0.0959	0.0955
8-24-49	Iron after treatment, ppm	25.0	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000
8-28-49	Copper after treatment, ppm	35.0	3.5000	3.5000	3.5000	3.5000	3.5000	3.5000

TABLE V—EFFECT of Time and Temperature on Rate of Reaction of the Calcium Phytate Upon White and Cider Vinegars

	Distilled White Vinegar		Cider Vinegar							
	Date	ppm.	#1	Date	#2	Date	#3	Date	#4	Date
Iron before treatment, ppm.	8-25	4.00	9	8-25	40	8-10	30.0	8-25	25.0	7-23
Iron after treatment, ppm.	8-26	2.50	4	8-28	5	8-17	12.5	8-26	2.5	8-23
Iron after treatment, ppm.	....	....	..	....	..	....	7.0	8-28	....	....
Iron after treatment, ppm.	....	....	..	....	..	....	6.0	9-3	....	....
Copper before treatment, ppm.	8-25	1.50	10	8-25	..	....	35.0	8-25	35.0	7-23
Copper after treatment, ppm.	8-26	1.25	4	8-28	..	....	25.0	8-26	5.0	8-25
Copper after treatment, ppm.	....	....	..	....	..	....	20.0	8-28	....	....
Copper after treatment, ppm.	....	....	..	....	..	....	2.0	9-3	....	....

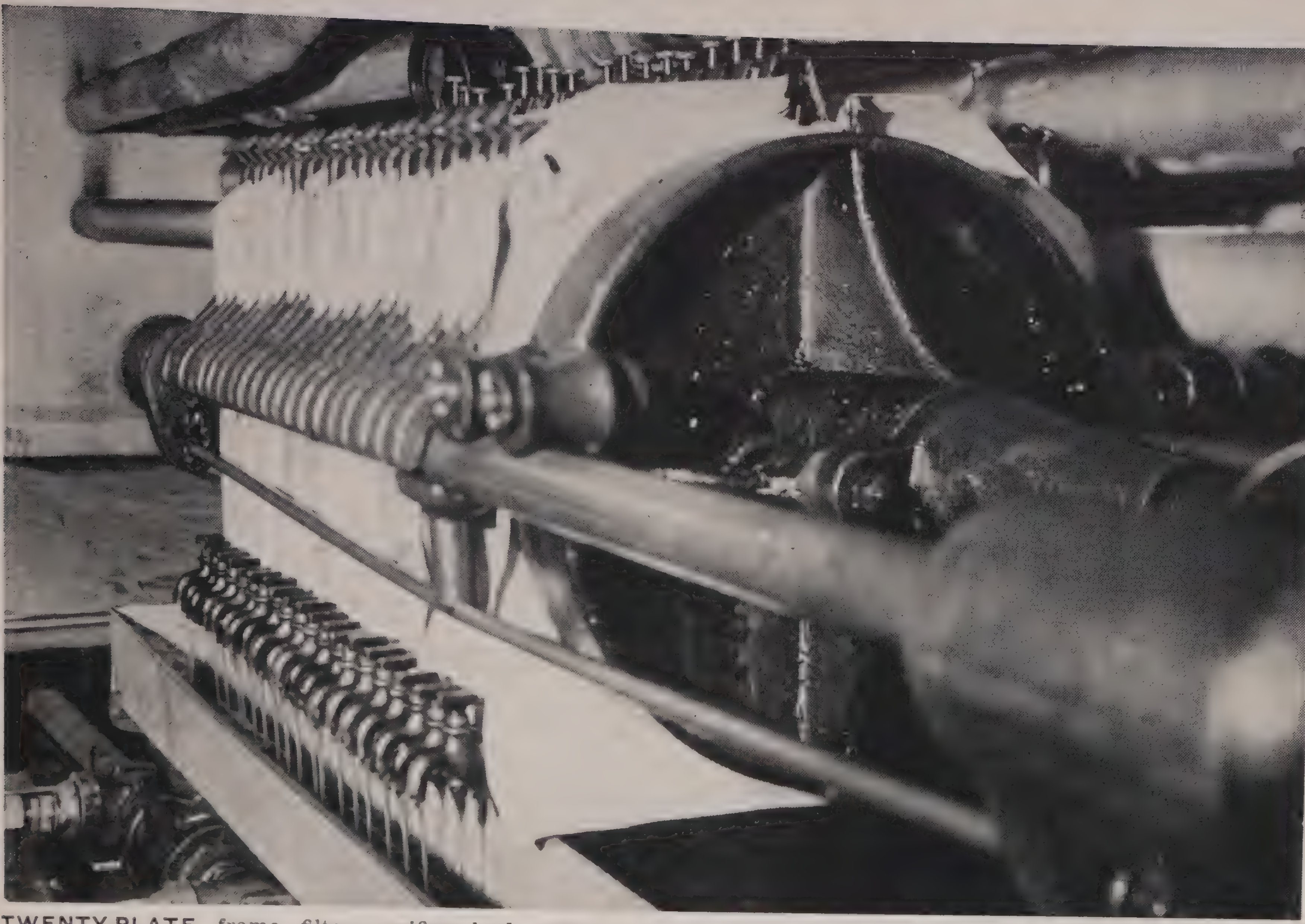
TABLE VI—COLOR AND TANNIN Levels Before and After Treatment of Vinegar with Calcium Phytate

Cider Vinegar Number	Color* Before Treatment	Color* After Treatment	Tannin Before Treatment, %	Tannin After Treatment, %
1	6.0000	3.0000	0.0249	0.0166
2	4.0000	3.5000	0.0270	0.0249
3	5.0000	5.0000	0.0270	0.0166
4	6.0000	2.5000	0.0249	0.0124

*In arbitrary units, as determined by Nissen method (see Ref. 2, end of article).

TABLE VII—EFFECT of Adding Calcium Phytate to 5 Percent Acetic Acid Solutions Containing Lead and Copper

Date	Blank (Control)	100 PPM. Lead	50 PPM. Lead	10 PPM. Lead	20 PPM. Copper	10 PPM. Copper	5 PPM. Copper	100 PPM. Lead 10 PPM. Copper	10 PPM. Lead 5 PPM. Copper
6-18-49	Clear	ppt.	ppt.	clear	clear	clear	clear	ppt.	clear
6-24-49	Clear	ppt.	ppt.	ppt.	ppt.	ppt.	clear	ppt.	ppt.



TWENTY-PLATE frame filter purifies lard. With new alkali-rendering and refining, further clarity is obtained by filtering after drying and bleaching. Resulting product's shelf-life is longer than that of steam-rendered lard.

Lard Comeback Promised By New Quality Process

Method calls for special alkali-rendering and refining, followed by bleaching and deodorizing. Consumer tests show superior product results

F. E. DEATHERAGE

Department of Agricultural Biochemistry and Institute of Nutrition & Food Technology, The Ohio State University

A new, top quality lard—one termed far better than the steam-rendered product, and promising to compete with other shortenings—has been developed at Ohio State University. Utilized is a new, semi-continuous alkali-rendering and refining process, which includes additional operations, such as special bleaching, refining and deodorizing.

When lard lost favor prior to World War II, the Kroger Co. became interested in finding a way to obtain better use of this item produced in its packing plant, which had a capacity of only 1,100 hogs a day. Accordingly, a project was established in 1940 through The Ohio State University Research Foundation and the Department of Agricultural Biochemistry to investigate the problem.

Outcome was the development of the new alkali rendering and refining process for producing a high-grade lard. A partial disclosure[1] was made and recently a patent[2] was granted. The process was made the property of The Ohio State University Research Foundation through assignment by the Kroger Co., that has now discontinued all its meat packing operations.

Lard's place in the American economy is rapidly re-approaching its status of ten years ago, when it was in surplus and in disfavor with the housewife and food processor. This staple product had lost its place as the standard domestic and commercial shortening. Hence, losses were sustained by the packer and the swine producer.

Where Lard Stands

The packer was, and is again, encountering formidable competition. He must pay more for the pig than he can get for the lard. For a product constituting 16 to 18 percent of the live weight of the pig, he is faced with the question of deciding which method of disposal will yield the least loss.

Today, progress is being made on this problem by both the farmer and packer.

The farmer is trying to raise a leaner and meatier hog—which is not as simple as one might suppose. And in the packing industry, interest in improved methods of rendering is indicated in the disclosures of Jesperson's Danish process[3] and the Hormel process[4]. Development of bland lards and animal-fat shortenings for domestic and commercial users foreshadows keen

Alkali Requirements Vary for Different Fats

TABLE—QUANTITIES of Alkali Solution, Bowl Residue, and Fat Yield for Various Tissues That Were Alkali-Rendered In Typical Lab Run

Kind of Fat	Amount of NaOH Solution in Percent of Raw Material	Total Undissolved Matter* in Percent of Raw Material	Yield* in Percent of Raw Material
Ham .	45–50	0.20–0.70	73–80
Back	40–45	0.06–0.15	84–90
Leaf	25–30	0.20–0.50	73–89
Caul (beef)	35–45	0.10–0.40	84–88

* It should be noted that small samples for laboratory rendering show more variation than larger scale plant operations.

competition for the producers of edible animal and vegetable fats.

About Initial Investigations

Before going into the process and product, let us review the initial studies that led to the development of the new process:

At the outset, Kroger made no limitations on the course of action to be followed. Its packing plant facilities and personnel and laboratories were made available to the investigator.

As a start, the company suggested the possibility of using lard as a base for spreads like margarine. Accordingly, the first job was to study the requirements of a lard that might be used in this manner. It was soon found that before U. S. No. 1 lard could be employed, bleaching, alkali refining and deodorization probably would be required. And it was also observed that more exhaustive deodorization might substitute for alkali refining (and this treatment is currently practiced). Furthermore, the lard would have to be fortified with antioxidants.

Two things were discovered: (1) Additional processing—beyond conventional steam rendering—would give a high over-all processing cost per pound of finished product, and (2) the lard would have general use as a shortening or base for other foods.

Conventional Rendering Unsatisfactory

Because of high processing costs and product losses with conventional rendering and caustic refining, studies were made to see if the rendering methods could be improved. Here, it was essential to determine the nature of pig fat *in situ*. In other words there was this question: Are the undesirable properties found in steam-rendered lard—odor, color, smoking and poor keeping quality—natural to pig fat, or are they imparted to the lard by the 6- to 12-hr. steam treatment used in prime steam rendering?

To find the answer, samples of fresh pig fat, such as back, ham and leaf, were extracted with freshly re-distilled ether. Others were extracted with freshly re-distilled acetone.

These solvent-extracted lards had free fatty acid contents of 0.10 to 0.15 percent, as contrasted with 0.3 to 0.5 percent, or more, for regular lards. Unlike the undesirable grays and gray-browns of prime steam-rendered lard, the color of unbleached solvent-extracted lards was a delicate light yellow. The odor was suggestive of lard, but less pronounced. And the keeping quality was about 50 to 100 percent greater than regular lard.

But the contrast between solvent-extracted and open-kettle rendered lards was even greater. When the products were prepared by grinding the tissue, gently heating it to 122.0 deg. F., and filtering off the fat, they were comparable to solvent-extracted samples. These tests indicated that the prime-steam or open-kettle rendering processes result in many of the undesirable properties in conventional lard.

Alkali Digestion the Answer

At first, laboratory and plant-scale experiments were carried out on rendering methods that would yield a product essentially like the natural pig fat *in situ*. These tests showed that the lower the processing time and temperature, the better the final product. And if the raw material were reduced to fat and liquid phases, the fat could be continuously separated by centrifuging.

To accomplish this, it would be necessary to dissolve the solid proteinaceous material in ham facings, back fat, and the like, in the water phase of the fat tissue by a relatively mild treatment. Of all the methods tried, liquefaction of the proteins by aqueous sodium hydroxide showed the most promise. In fact, such treatment was desirable, since the fat would have to be refined by the caustic method at the same time.

Extensive laboratory tests were undertaken to determine the conditions necessary for proper alkali digestion and effective separation of fat by centrifuging. For proper alkali digestion, it was necessary to set up conditions to prevent saponification of the fat. The answer was a 0.4 to 2.0 percent aqueous solution of sodium hydroxide and digesting at temperatures up to 212 deg. F. for approximately one hour. This treatment dissolves almost all of solid material, thus making a liquid biphasic mixture capable of separation with a centrifuge.

The separator used was a Sharples laboratory supercentrifuge, operating at 25,000 rpm. Its centrifugal force is comparable to that of the commercial No. 6 Sharples centrifuge.

After the initial separation, two or three hot water washes, followed by centrifugal separation, can be made. The final, washed, alkali rendered and refined lard closely resembled natural pig fat—without most of the undesirable properties found in conventionally rendered lard.

How Lab Tests Were Run

A typical laboratory run consisted of: (1) Mixing 6,275g. of skin-on back fat (ground through ¼-in. and ⅛-in. plates) with 40 percent of its weight of hot, 1.75 percent sodium hydroxide and a 3 percent salt solution, (2) heating the mixture in an open steam-jacketed kettle for one hour to a final temperature of 203 deg. F., (3) separating the hot mixture with a centrifugation using No. 9 ring dam, and (4) washing the fat with 20 percent of its weight of hot 5 percent salt solution and then twice with water—separating after each wash.

Yield: Lard, 5,402g.; total undissolved solids, 8g.

In the laboratory stage of the investigation, it was necessary to determine the amount of alkali needed to render all types of tissues going into lard and also the amount of solid matter likely to collect in the centrifuge bowl, thus necessitating knock down and cleaning.

The new process is subject to a number of variations. Alkali solutions can be varied in quantity and strength. Salt can be used in the digesting solution and/or wash to aid separation, but it is unnecessary. Acid washes may be employed, as well as partial acidulation of the digestion mixture prior to primary separation.

Pilot Plant Efforts

Alkali rendered lards produced in the laboratory were of excellent quality and plans were underway for the construction of a pilot plant. But about this time, the U. S. became involved in World War II. And it became apparent to Kroger that the construction of a pilot plant in its own packing plant would have to be delayed indefinitely. Since the company wished to be in position to adopt the process following cessation of hostilities, other methods of carrying on pilot plant-scale experiments were sought.

Although the alkali-rendering process was new, equipment needed to carry it out was already being used in the food industries. Fortunately, facilities at other plants were made available. And it was therefore possible for us to carry out alkali-rendering experiments on 500-lb. lots of raw material. Cooperative efforts of several firms were pooled so that sufficient information could be gathered to formulate plans for the installation of a commercial unit.

Numerous experiments, patterned after the laboratory experiments, were carried out using 300 to 400 lb. of raw material. Commercial No. 6 Sharples centrifuge, equipped with a separator bowl and ring dam No. 35 or 36, was used. The data sought included centrifugation rates, amount of undissolved residue necessitating centrifuge knockdown, style of pumps and digestion tanks, yields (or losses), and operating conditions.

Conducting Large Scale Tests

A typical large scale experiment was conducted in this manner: A lot of 300 lb. of back fat (ground through a ⅛-in. plate) was mixed with 120 lb. of hot, 1.75 percent sodium hydroxide solution. Next, the mixture was heated in a steam-jacketed kettle with gentle agitation. A temperature of 200 deg. F. was attained within 30 min. and maintained for an additional half hour. Following digestion, primary separation was made at a rate of 1,800 lb. of raw tissue per hour. Then the fat was washed with 60 lb. of hot, 5 percent brine and again with 60 lb. of hot water. The fat was separated after each of these washes at rates of 1,650 and 1,900 lb. per hr. respectively.

Total undissolved solids amounted to 0.42 lb. (0.14 percent of raw material) in the primary separation. This figure indicates that a primary centrifuge would have to be cleaned after 6,000 lb. of the raw material passed through it. However, by properly designing the equipment, the solids can be removed prior to separation, thus preventing undissolved solid matter from reaching the centrifuge.

The amount of fat recovered by this large-scale test was 253 lb., or 84.3 percent. Losses of neutral fat and phospholipids in aqueous liquors (digestion and wash) were 0.12 percent of the raw material. Loss of total fatty acid (ether soluble after acidulation of aqueous liquors) amounted to 0.32 percent of the raw material.

Twelve Important Findings

Numerous large-scale experiments were undertaken with commercial centrifuges to study some of the factors responsible for the success of the rendering process. Some of the more important findings follow:

1. Raw material should be as fresh as possible, preferably coming directly from slaughtering and cutting.

2. Material can be ground with comminuting or screw-type units.

3. Ground material should be treated with alkali soon after it is ground. And it should not be heated before it is added to the digesting solution, because heat-denatured protein does not readily dissolve in the alkali.

4. Digestion can be conducted in the presence or absence of salt. But salt does tend to aid centrifugation. Use of up to 5 percent salt, (preferably commercial grades containing a small amount of calcium and magnesium chlorides), may be effective in the first wash.

5. Usually, a second water wash is sufficient.

6. Use of procedures that promote saponification must be avoided. An example is the application of excessive temperatures. Hence, employment of waste or exhaust steam as a source of heat is an advantage.

7. The digestion period can be prolonged somewhat, if necessary.

8. Agitation of the digesting mixture need not be excessive, and centrifuging can be aided provided agitation is stopped about 5 to 10 min. prior to separation. This technic will remove solid matter and some of the aqueous liquor before they reach the centrifuge.

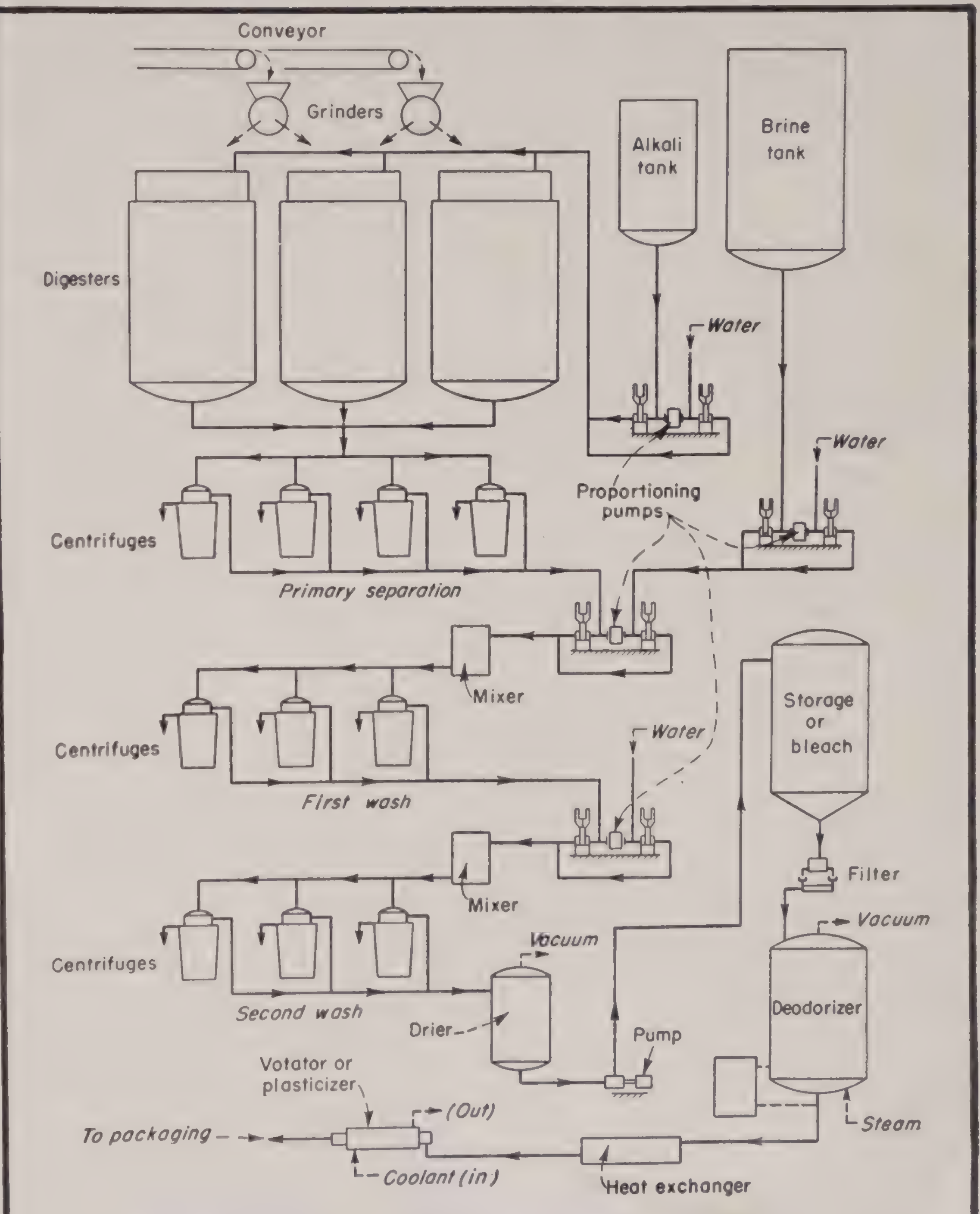
9. Centrifugal pumping must be avoided prior to the primary separation, and the digestion mixture should if possible, be gravity-fed to the primary separators.

10. Bones cannot be processed, but most fatty tissues going into rendered pork fat as well as those going into U. S. No. 1 lard, can be effectively handled.

11. Sweet-pickle fat gives a quality lard when alkali-rendered.

12. If alkali-rendered lard is used without deodorization, a final dilute acid wash, such as 0.5 percent phosphoric acid, improves flavor.

How Lard Is Alkali-Rendered and Refined



PREPARATION OF LARD BY ALKALI RENDERING AND REFINING PROCESS

Laboratory and large-scale experiments checked in almost every detail on processing, quality of product, and yield. The rendered material is immediately ready for the usual bleaching, hydrogenation, deodorization and plasticizing operations. All these operations have been carried out, except hydrogenation. Handling of alkali-rendered lard is identical to the procedure with other edible fats in these operations.

The new process is semi-continuous. Digestion is handled in a batch manner, while separation and washing are continuous. (However, there was some evidence that digestion might also be made continuous.) Processing—from raw material to rendered lard—takes 1¼ to 2 hr. But it appears that it would take 8 to 10 hr. to complete the entire process—from raw material to the finished, deodorized (batch), and packaged shortening.

When this project was undertaken, the process outlined in the diagram was drawn up for a Kroger plant killing 100 cattle and 1,100 hogs a day. Standard processing equipment required consisted of two grinders, three 1,200-gal. steam-jacketed kettles equipped with agitators, one 200-gal. supply tank for 20 percent sodium hydroxide, one 1,200-gal. supply tank for 20 percent salt solution, four primary centrifuges, six washing centrifuges, four proportioning and pumping devices, two mixing and heating chambers for the washes, and one vacuum dryer.

This equipment, of course, excluded filtering, deodorizing, plasticizing, and other supplementary apparatus used in the conventional method of processing bland shorteners.

About the Product

Alkali-rendered lard has a delicate yellow color (Lovibond: 2.0 yellow, 0.3 red) when melted, and white when plasticized. It has a mild uncooked odor. Its free fatty acid content is about 0.01 percent, and its smoke-point is 475-500 deg. F. This lard's keeping quality exceeds that of ordinary steam-rendered products by about 50 percent (incubation in air at 140 deg. F.). Alkali-rendered lard responds to antioxidants such as NDGA, the gallates, and tocopherols in a manner similar to most animal fats. It also retains the excellent plastic properties and chemical characteristics of lard.

Bleaching with charcoal or earth is unnecessary for alkali-rendered lards. If present, a small amount of chlorophyll may, if desired, be removed from the lard by using 0.01 percent or less, of Special Filtrol. Furthermore, some color may be removed by deodorization (to about 1.0 yellow, 0.3 red). Alkali-rendered beef fat is somewhat more yellow than lard processed from pork fat.

The flavor and odor of alkali-rendered lard are less pronounced than those of ordinary lard. And, for many purposes, the lard can be used without deodorization. However, for most purposes, deodorization is desirable, and it can be done more rapidly with alkali-rendered lard than many edible oils. In the laboratory, deodorization is complete in 1 to 2 hr. at 392 deg. F. and 0.01 mm. Pilot plant deodorization on 500-lb. lots at 392 deg. F. and 5 mm. was complete in 4 hr. No experiments were done for shorter periods. In either case, very little steam-distillable material appears.

There seems to be no troublesome flavor reversion in deodorized, alkali-rendered lards. Cans of 6-yr.-old alkali-rendered lards showed no appreciable flavor deterioration.

Consumer Acceptance Tests

In order to determine the quality of the product, consumer acceptance tests were made by Kroger's market research department. Samples for these tests were made on a pilot-plant scale. But since the sample preparation was divided among four firms in three cities in the course of a month, their quality was not as satisfactory as that attained from samples processed in a straight-line operation.

Leaf, back, and ham fats were alkali rendered, dried, filtered and deodorized. Next, these fats were blended to simulate a commercial lard, plasticized in a Votater, and packaged. Blends of undeodorized, alkali-rendered fats were similarly plasticized and packaged.

Comparative "blind" tests were made on consumers with the following significant findings: (1) Undeodorized, alkali-rendered lard was preferred to a commercial high grade steam-rendered lard; (2) deodorized, alkali-rendered lard was preferred to undeodorized, rendered lard; and (3) deodorized, alkali-rendered lard was comparable in acceptance to commercially available hydrogenated vegetable oil.

Because of Kroger's extensive baking operations, tests were conducted to determine the possibility of using alkali-rendered lard and beef fat in compounding commercial and domestic shortenings. Using these fats, it was possible to make an all-purpose shortening, doughnut frying fat, bread shortening, a biscuit and cracker shortening, and a high-ratio cake shortening—all comparable in quality to similar commercial products.

Use of deodorized, alkali-rendered lard as a margarine base showed some promise. And deodorized, alkali-rendered lard oil was satisfactorily used in salad dressings.

The by-product of the alkali-rendering process ... during steam rendering. But the method of utilization and treatment of the alkaline protein hydrolysate must depend upon the plant. If salt were not used in the digesting solution, the resulting hydrolysate could be neutralized and sent to the tank for incorporation into meat scrap, or it could be dried by itself.

The hydrolysate consists of an acid-precipitable fraction that is soluble in 70 percent ethanol and a proteose-peptone fraction. These fractions amount to 0.2-1.7 percent and 0.2-3.0 percent of the raw tissue. If the market warrants, these products could be separated.

During the investigation, some commercial interest was found in these materials. In addition to nitrogenous material, the acid-precipitable fraction contains some free fatty acid, mixed phosphatides and any neutral fat lost (usually insignificant in amount). It is easy to recover this fraction by acidulation and filtering. But the proteose-peptone fraction is somewhat more difficult to separate in pure form.

The most effective utilization of the hydrolysate has not been studied. It was felt that the alkali-rendering process had sufficient merit in producing a quality fat in greater yields than the regular method so that it would be unnecessary to depend upon nitrogenous waste to assure profitable use of the alkali-rendering process.

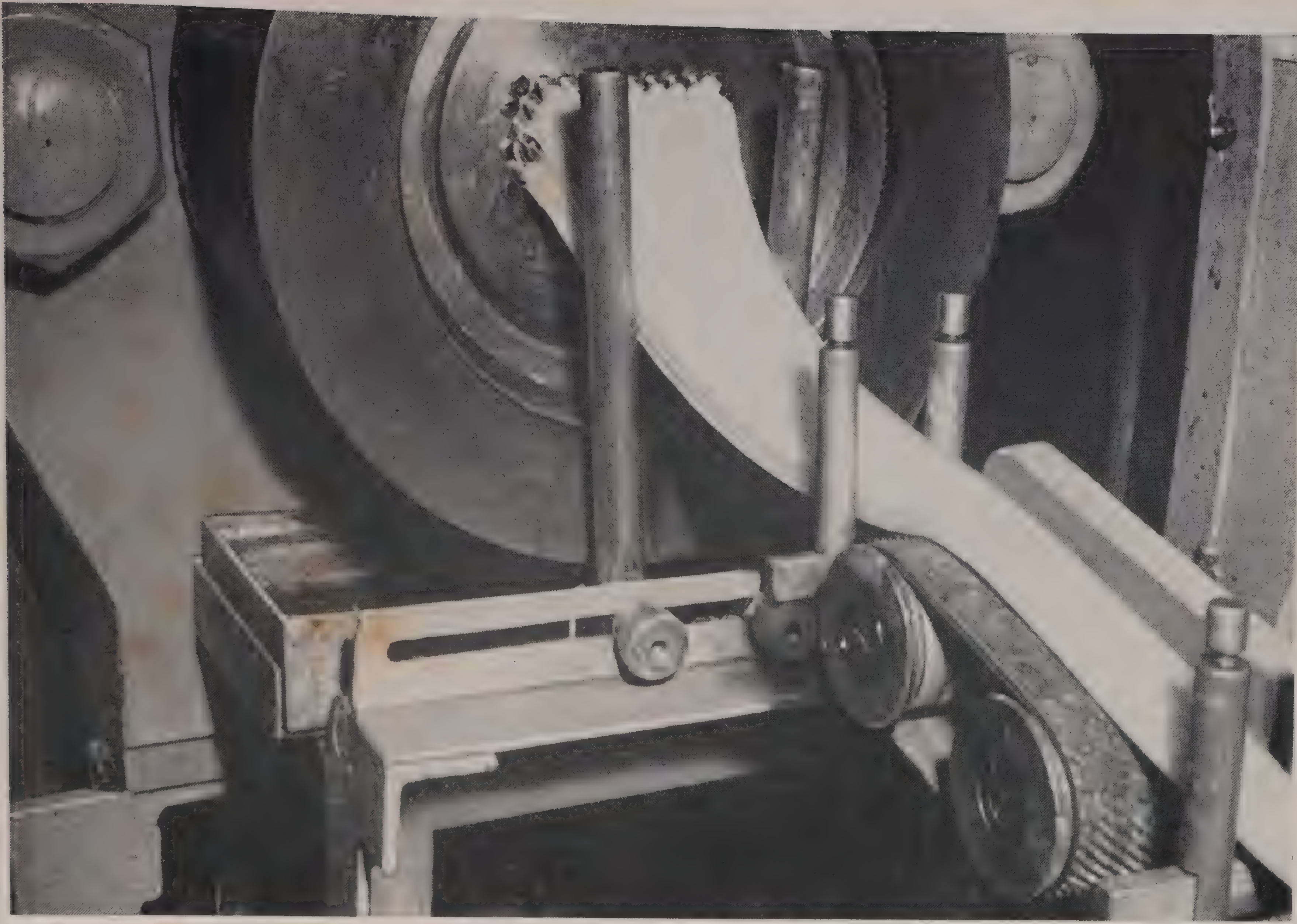
In Summary

The conventional lard was considered as the standard shortening up until 30 to 35 years ago. But today, bland shortenings and edible oils are desired by most commercial and domestic users. Furthermore, advances made in food technology and the chemistry and processing of fats and oils have resulted in "tailor-made" commercial shortenings. That animal fats may be used for bland "tailor-made" products is a challenge to the meat packers.

Two approaches to this challenge are being tried by producers of animal fat. One is to superimpose refining, bleaching, hydrogenation and deodorization operations and the addition of emulsifiers and antioxidants to conventional steam-rendered pork and beef fats. The other approach is to utilize new rendering technics designed to improve the fat.

These new methods either facilitate or eliminate some of these same operations. For the packer, the question appears to be which way is more efficient, gives greater yield, costs less, produces a product the consumer really wants, and yields the greater over-all profit.

(*Turn to page* 198)



EXTRUDER produces stratified, porous hard candy. Superseding old pull-and-fold method, it assures uniform texture.

Doing It Better Is a *Habit* at Whitman's

And candy maker now continues century-long stride with newly efficient unit operations. Featured are special extruder and vacuum expander

JOHN V. ZIEMBA
Assistant Editor, "Food Industries"

Making better and better candies for more than a century—and doing it with progressively higher efficiency—is a notable achievement. S. F. Whitman & Son of Philadelphia has been doing just that.

Behind this progress lies much more than the selection of quality ingredients, close control in processing, and careful inspection. Prominent are the advanced technics that have been applied in many different unit operations and processes—and it may be noted that they are of interest to the food processing industry as a whole. The equipment is not only more efficient but it also improves quality.

Backed with ample funds by management, the company's technologists have devised many of the better methods and processes. And much of the new and improved equipment has been designed by the firm's engineers and built in the company machine shop.

Whitman's advances have covered a wide range. Better technics have been introduced in the making of hard candy, the production and refining of chocolate and coatings, and in the forming, mixing, assembling, cooling, handling and packaging of various candies.

Careful study of the former hard candy operations revealed many unnecessary handling steps, each involving an appreciable amount of time and labor. And some operations proved open to quality-improvement measures. As a result of the preliminary study, methods were developed for: (1) Extruding soft pulled candy, (2) vacuum-cooling pillow-shaped mints, and (3) improving packaging of the assorted hard candies.

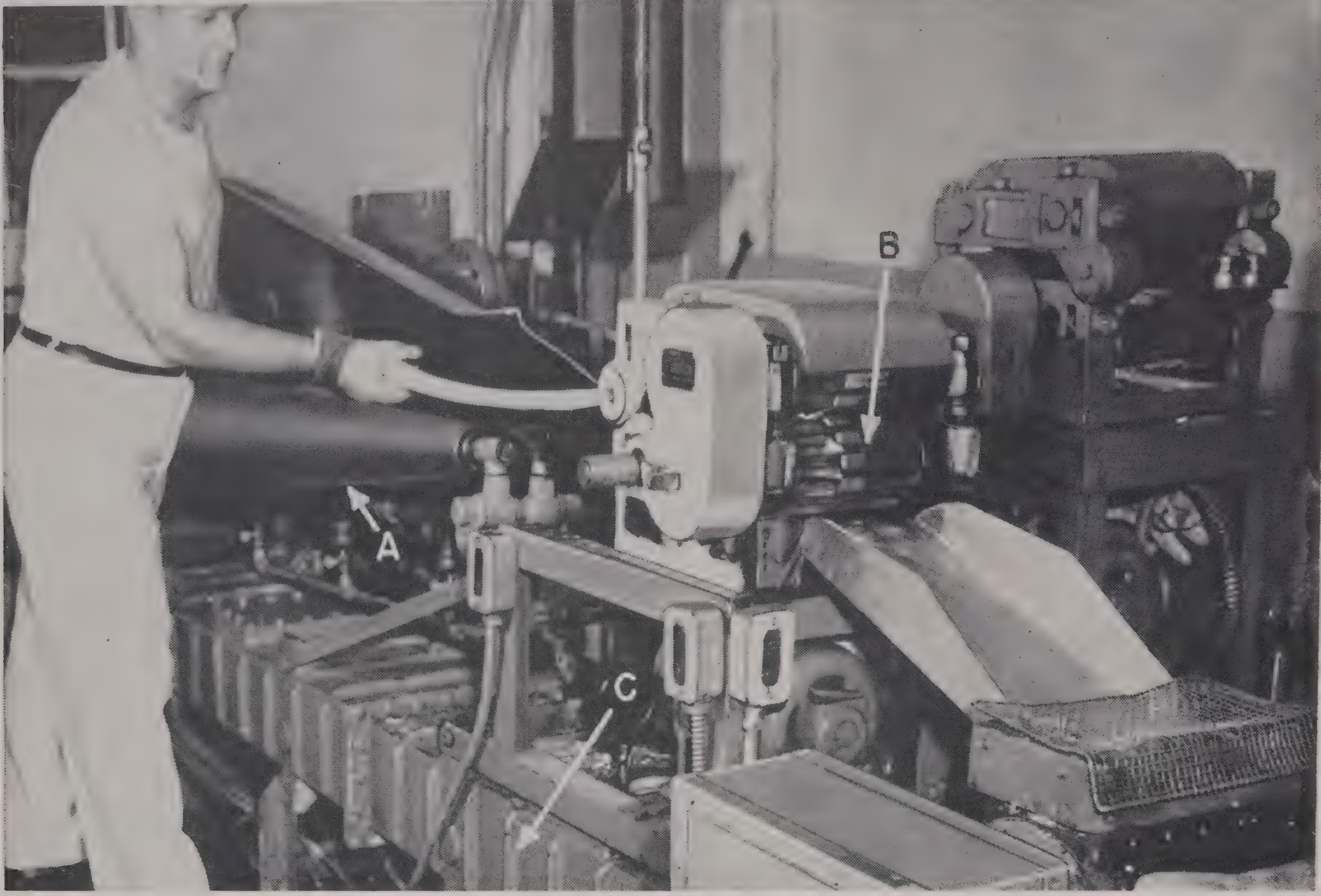
ADVANCED FOOD PLANT ENGINEERING
35th of a Series

Extruder Forms a Better Candy

Invention of an extruding machine for forming a hard candy with stratified layers that entrap air to make the pieces "porous" was one notable achievement. Adoption of this machine was a radical departure from conventional honeycomb-candy make-ready operations. The extrusion assured more uniform control of size, texture and porosity of hard candies. Furthermore, this company-devised process turns out 50 percent more usable candy than the former method, and at a higher rate.

The trouble with the old method was the multiple handlings required—repeated pulling and folding of the batch—to give the candy its porosity.

A-B-C of Vacuum Expander That Doubles Size of Candy



VACUUM unit cools and expands pillow-shaped mints. **Batch is formed into conical shape** by tapered rollers (A), then fed into rotating cutter (B). Pieces drop into vacuum-cooling tunnel (C) and there expand over twice their original volume.

Besides, this excessive handling sealed some of the pores, imparting toughness. And it took two men about twice as long to pull and fold the candy as it now takes one man to extrude it.

How Candies Are Extruded

Up to the forming operation, the honeycomb candy is made in the same way as before. Sugar, corn syrup, molasses and salt are weighed into steam-jacketed copper kettles, where a 120-lb. batch is cooked to the proper temperature and then held under a high vacuum. After cooking, the candy is poured into three stainless steel pans, each holding 40 lb. Next, each small batch is dumped on top of a cast-iron table, leveled out with an iron bar, and cooled. Color and flavor are added at this point. Then, the candy is placed on a puller and aerated.

Formerly, the 40-lb. batch was formed into a hollow tube with a rolling pin. Men would then pull the tube and fold it in half, repeating this operation to give the candy its porosity. Next, the batch was carried to the tapered-roll spinning table and reduced to the proper width. Finally, the strip was automatically cut into pieces, which were then conveyed through a cooling tunnel.

With the extruder, the batch is loaded into a steam-jacketed cylinder. Then a hydraulic ram forces the candy through holes in a steel plate, the strands combining to form the "honeycomb" structure. The extruded strip of candy is reduced in size as it passes between vertical bars. Finally, the strips pass through an adjustable cutter, which chops them into 1-to 3-in. pieces that are conveyed through a cooler.

Development of the method for vacuum-cooling and expanding pillow-shaped mints resulted in an entirely new kind of hard candy. It is light and airy so that it actually melts in your mouth. And a pound of it has considerably greater volume than the same weight of regular pillow mints.

This candy contains sugar, corn syrup and invert sugar. After cooking, it is dumped from the kettle, cooled and machine-pulled, the flavor being added during this operation.

When shaping the candy after pulling, strips of red candy (previously prepared in small batches and hand-pulled into strips) are placed evenly over the piece, giving the mint its characteristic red and white stripes.

Now ready for cutting, the candy is loaded onto a spinner that has two gas-heated, corrugated, cast-iron rollers to form the confection into a conical shape. The smaller end of the resultant cone is fed into a machine where two revolving knives cut it into small pieces.

Vacuum Increases Size of Mints

These pieces drop into a vacuum-cooling tunnel. Traveling through on a 10-in. canvas belt, the candies are subjected to a vacuum, which expands them to more than twice their original volume.

At the end of the tunnel, the pieces are discharged onto an elevator that carries them to a conveyor going to the packing table. Finally, the pieces are filled into 6-oz. cans and sealed.

Novel Mixing Method

Better uniformity in the proportioning and mixing of assorted hard candies has been attained on the new packaging line. Another notable advantage is the reduction in the amount of handling required to mix the 17 different kinds of candies. There is now an ingenious use of belts, hence there is no longer the congestion that existed when the 17 varieties were stored in cans. Formerly, the assorted hard candies were mixed and packed this way:

Each of the 17 kinds of candy was collected in 50-lb. cans and stored on the floor of the packaging room. Then, to make the assortment, about a third of the contents of each can was dumped into a 300-lb. bin, where the variety was mixed with a wooden paddle and finally hand-packed into glass jars.

As revamped, the operation is much more efficient. Now, a batch of hard candy—one of the 17 varieties—is conveyed directly from the cooling tunnel into a 60-lb. stainless-steel, wire-mesh hopper that travels over a 1,000-lb. stainless-steel bin. The hopper distributes the candy in an even layer over the bottom of the bin. And by repeating these two steps with the remaining 16 varieties, 17 different layers are built up in the bin.

Mixing is completed by conveyors as follows: A wire-mesh belt, forming the bottom of the collection bin, tumbles the candy out of the bin in a manner which simultaneously draws on all 17 layers. This mixture then drops onto a lateral conveyor, which later discharges it into another bin at the packing station.

High Capacity Cooler

Installation of multi-tier coolers has resulted in more uniform control over the quality of chocolates during cooling. And another thing: Production is twice that of conventional tunnel cooling—with two-thirds less floor space. The chocolates are cooled in $3/4$ hr., as they travel back and forth across twelve 50-ft. tiers in an air-conditioned room (temperature 60-63 deg. F.).

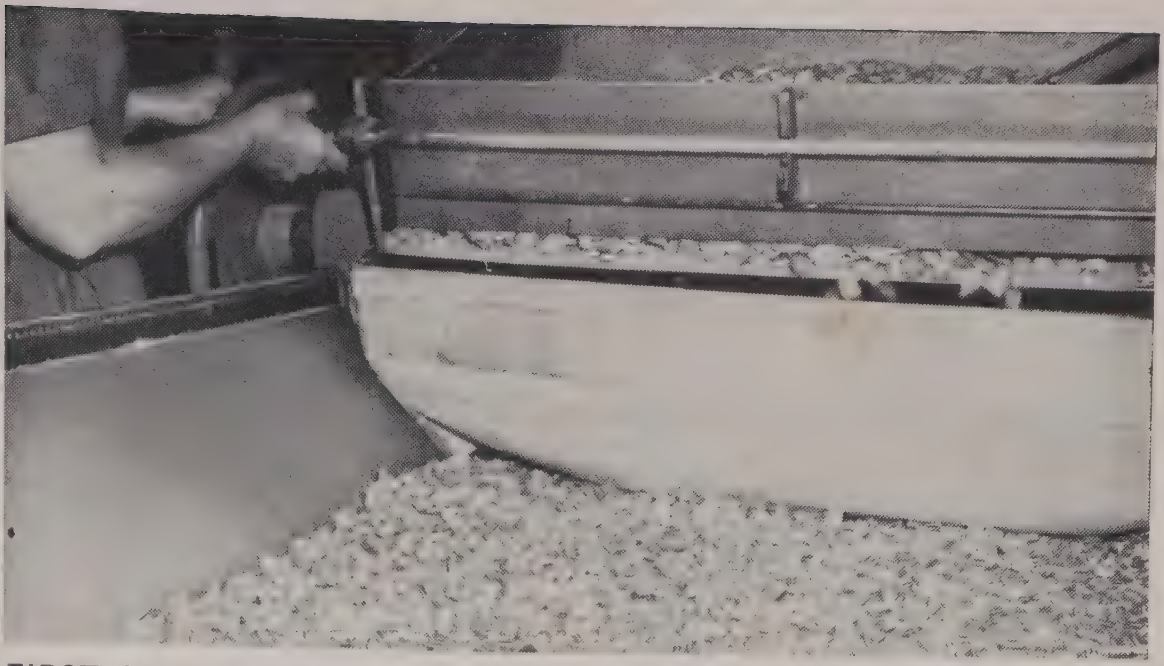
In the course of installing these coolers, two improvements were also made in delivering coating from tempering kettles to enrobers. The coating is now gravity-fed into enrobers, thus doing away with the difficult bucket feeding system. Pipes delivering coating to enrobers are insulated to assure a uniformly tempered chocolate.

Better Grinding and Refining

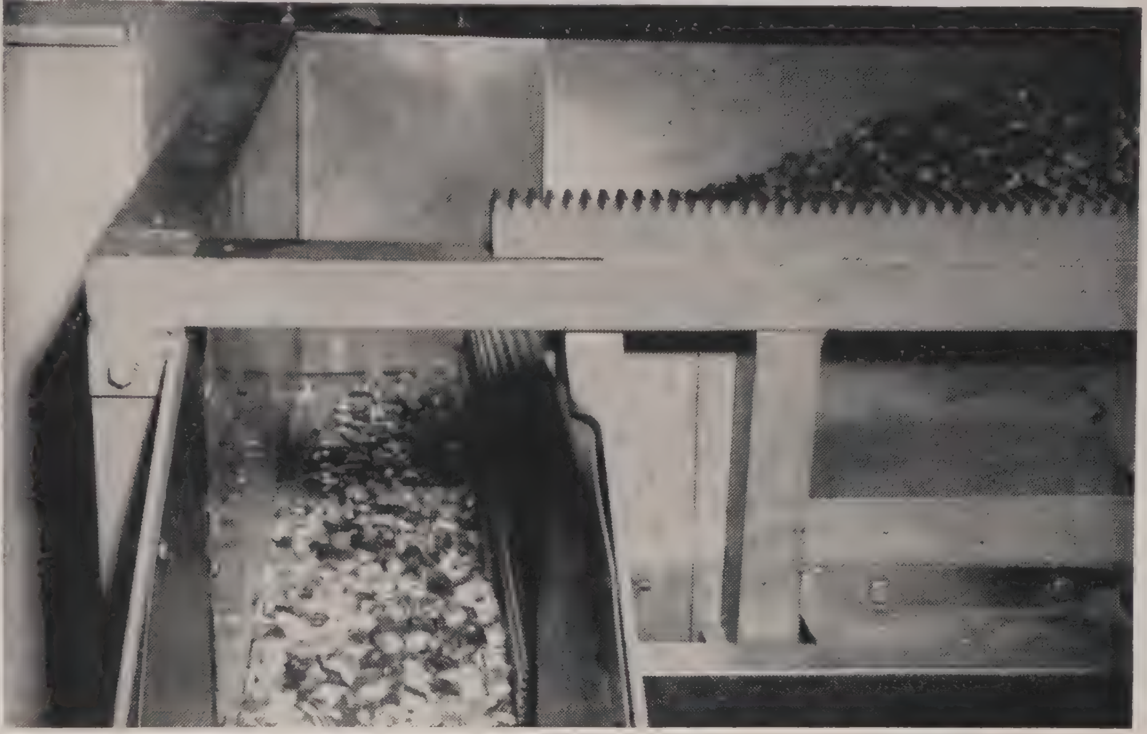
Finer reduction of the chocolate-liquor particle size has been attained with a new continuous Lehmann triple mill, improving chocolate quality. Furthermore, this mill has increased production and has reduced wear, and hence maintenance, on the three-roll liquor refiners.

In the new chocolate-liquor refining system, roasted cacao nibs are gravity-fed into a continuous pregrinder. Here, the nibs are pulverized as they pass between three vertical plates—a center plate revolving at 2,500 rpm. between two stationary plates. The production through this unit is 1,000 lb. per hour.

From the pregrinder coarse liquor is pumped to a continuous three-stage mill that reduces the size of the cacao particles so that 90 per cent of the liquor goes through 200-mesh screen.

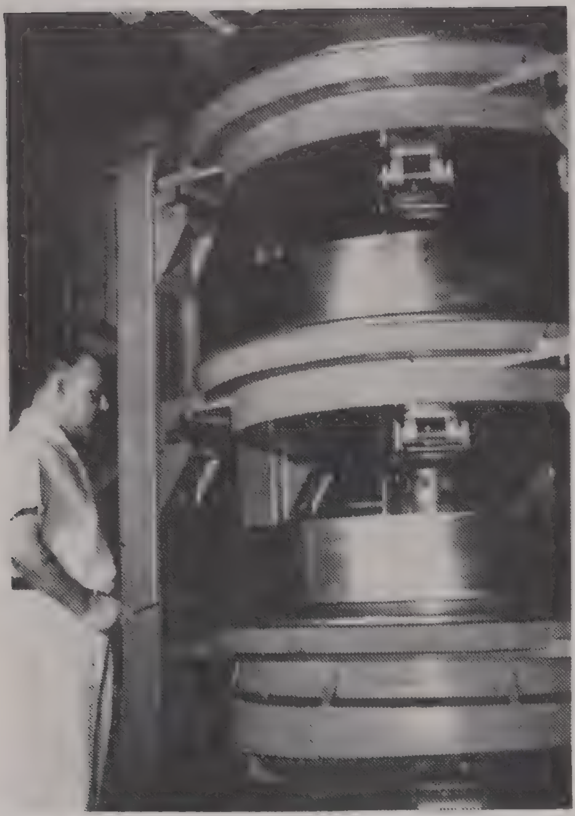


FIRST STEP in mixing hard candy assortment. Seventeen different candies are distributed by traveling hopper (top right) in even layers in 1,000-lb. collection bin (bottom). New method minimizes handling, while eliminating congestion caused by old bulk storage of cans on the floor of packing room.

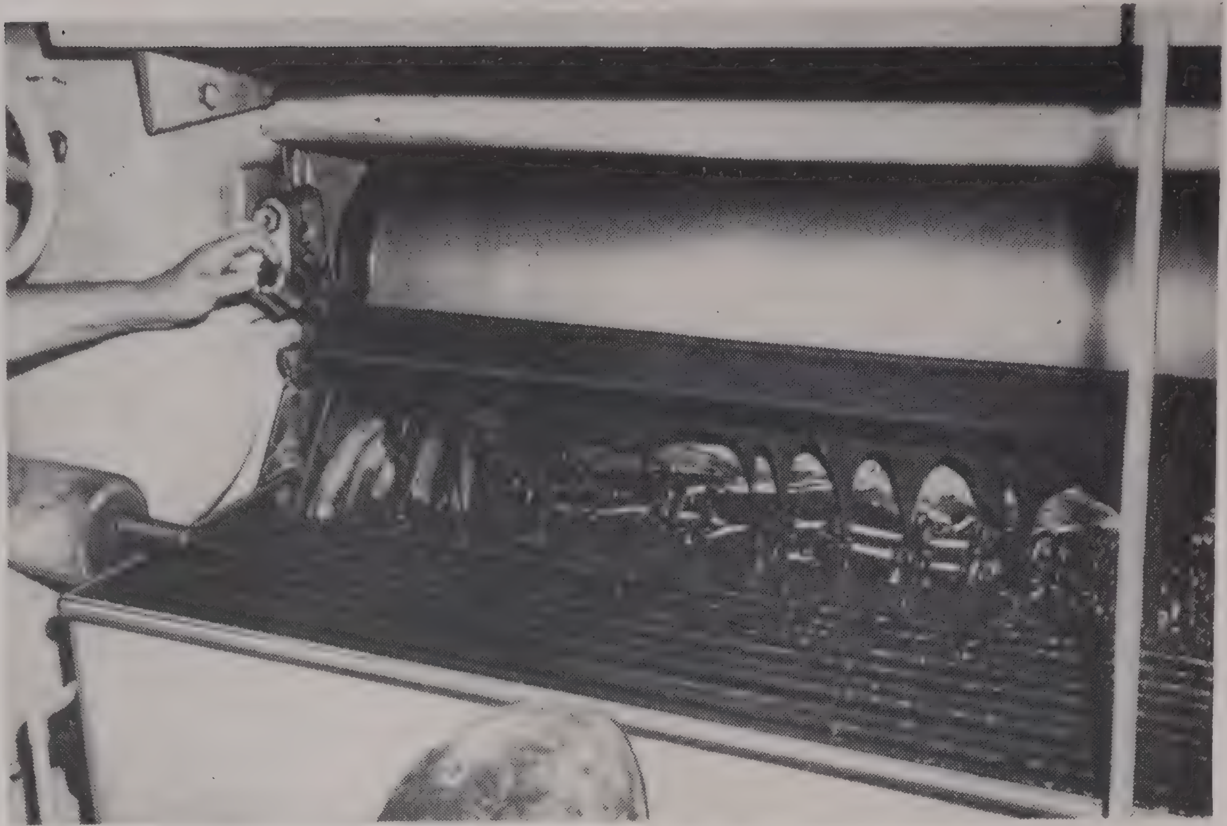


SECOND STEP in mixing. Conveyor at the bottom of collection bin (right) tumbles candy from all 17 layers onto lateral conveyor (left). Candies are further mixed as this second belt dumps pieces into 1,000-lb. bin at packing station. Old way was to do all the mixing with paddles at this station.

FINAL STEP. Varieties intermingle as candies discharge from wire-mesh conveyor (top right) into packing bin (center). Girl fills glass jars and puts them on center conveyor. Second girl takes jars from belt, stands them on vibrator to obtain firm pack, and adds candy when needed. Later, jars are capped.



THREE-STAGE continuous mill was installed to get finer reduction of coarse chocolate liquor, thus producing improved coating chocolate.



THREE-ROLL chocolate liquor refiners continue the job. Liquor makes two passes through the first refiner. Then, liquor is pumped through two additional units. It is then fine enough to pass through 300-mesh screens, ready to be mixed with other ingredients and processed into chocolate coating.

Each stage consists of a pair of horizontally-set carborundum stones. The top stone revolves at 44 rpm., while the bottom one is stationary. Liquor enters through a hole at the axis of the top stone and is forced outward and to the periphery through grooves between the grinding surfaces of the stones.

This triple mill's stationary stones are equipped with steam coils which apply heat to them about an hour before operations are begun. With this arrangement, the mill is at the proper temperature when liquor is first run through it.

The steam coils reduce power requirements in setting the mill into operation, and the heat assures uniformity in the first run of liquor.

Liquor Is Further Refined

Upon leaving the triple mill, the liquor is pumped into storage. Employed here are a sufficient number of tanks to provide the required flexibility in the making of chocolate coatings. For example, liquor can be pumped from storage as needed to make milk, vanilla, or bitter chocolate coatings.

Next, the liquor is pumped into the hopper feeding the first of three 3-roll water-cooled refiners that are operated in series. In each the liquor passes between the first and second rolls, then between the second and third rolls. The latter two rolls are set progressively closer together.

Each succeeding roll rotates at higher speed and in the opposite direction than the preceding one. And rolls on the second and third refiners are set progressively closer together so that liquor leaving the third refiner will pass through a 300-mesh screen.

Most of the liquor leaving these refiners is pumped into storage, ready to be used for coatings.

Making the Coating

Today, the quality coatings are made in this manner:

Refined liquor and melted cocoa butter are flow-metered into a 5,000-lb. horizontal emulsifier. Sugar is chuted into the mixer from the floor above. And other ingredients are added directly into the unit.

Made of cast-steel, the emulsifier is hot water-jacketed and equipped with two sets of mixing paddles. One set of paddles is arranged so that it forms a continuous scraping spiral. And inside this set, another set of shorter paddles whips up the coating in the opposite direction.

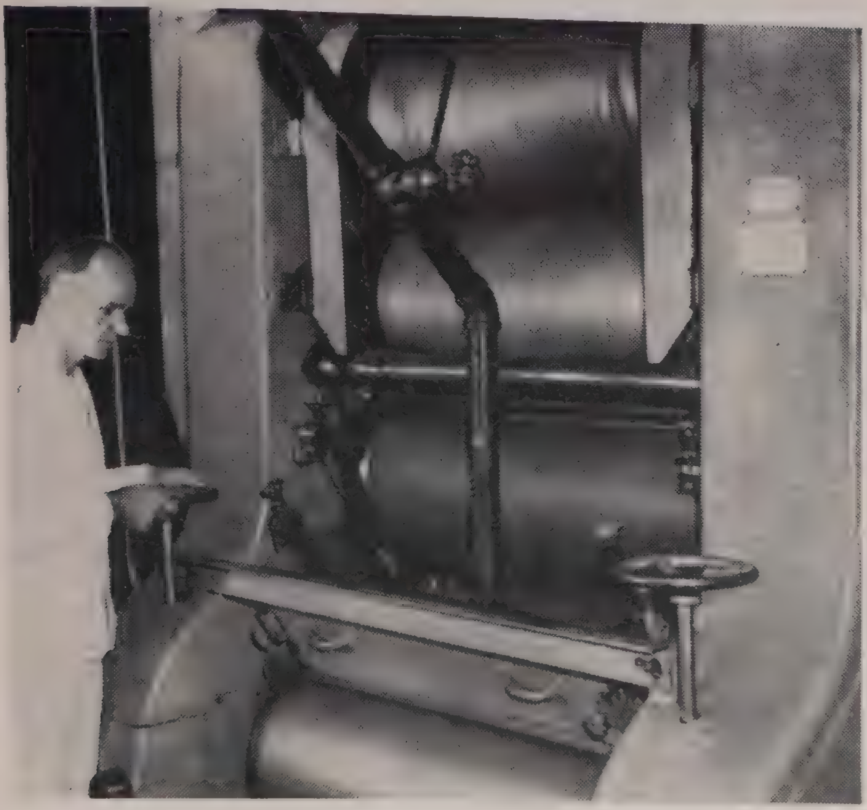
After the coating has been thoroughly mixed, it is transferred into another emulsifier that feeds it to a 5-roll refiner. This second emulsifier serves as a holding unit to permit continuous operation of the refining mill.

Operation of the 5-roll mill is similar

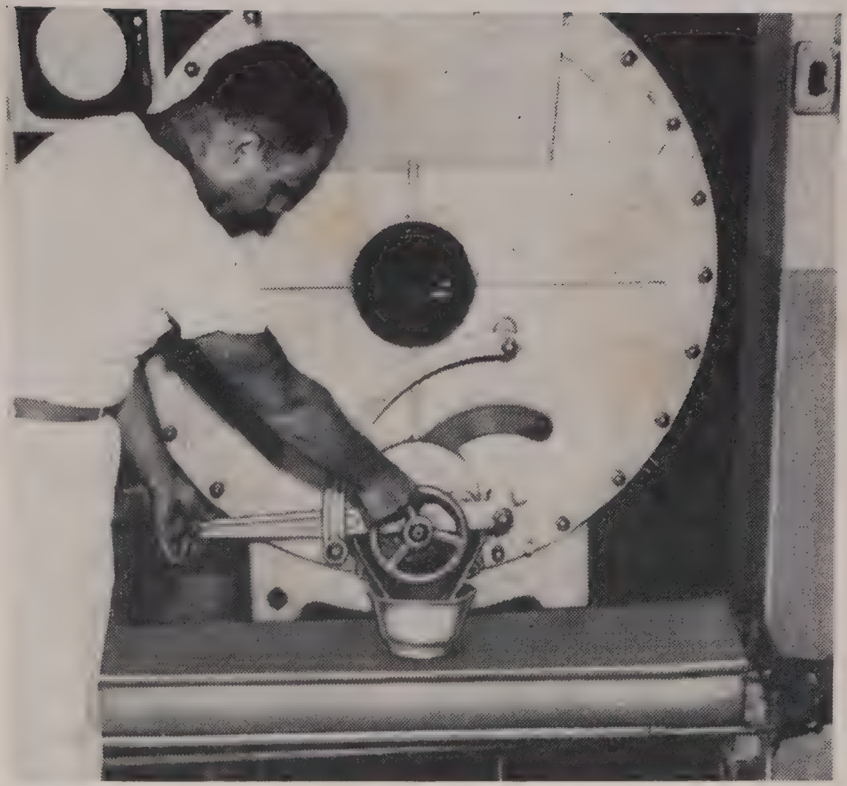
Old Packing: Takes girl months to learn

GIRL on tray-belt line packs six boxes at a time, picking chocolates from stock cases traveling along 100-ft. tray-type belt (right). It takes four to five months to train a packer. This line now serves as a labor-pool for the new chocolate-packing system, and it can be used to pack up to 8,000 boxes per shift.

Bring Better Chocolate Coatings



THIS FIVE-ROLL mill refines the coating chocolate. Rollers are like those on 3-roll liquor refiner. They are water-cooled, rotate at progressively higher speeds. Space between successive pairs of rolls is progressively smaller.



BRAMLEY MILL does final refining of the coating chocolate. This mill comprises a stationary corrugated cylinder with a rotating scraper. Grinding takes place as coating is whipped against the inside walls of cylinder.

to that of the 3-roll machine. The coating particles are progressively reduced in size as the coating passes between the horizontal, chilled-iron, water-cooled rollers under a pressure of 8 tons per square inch. A stationary knife scrapes the coating off the last roll, and the coating then goes into a third emulsifier. The capacity of the refiner is 700-plus lb. an hr.

From the third emulsifier, the chocolate goes to 1,000-lb. capacity Bramley horizontal refiners, where it is ground for only about half the time formerly required with the conventional chocolate process. Grinding takes place as a rotating scraper whips the coating against the surface of a corrugated cylinder. If the refiners ever carry too high a load, the motors shut off automatically.

Finally, the chocolate goes into 10,000-lb. storage tanks, ready for the tempering kettles in the enrobing department.

Highly Efficient Packaging

Efficiency in packaging assorted chocolates is attained through the use of conveyor lines of two types. One uses a tray-belt to carry the candy to the packers. The other employs a plain belt to convey the boxes past the packers.

There are two tray-belt lines and four plain-belt lines in the packaging department.

Most important single advantage of the tray-belt and plain-belt packaging lines for assorted chocolates is the great number of inspections the boxes of chocolates receive. This assures that nothing but a quality pack goes out of the plant. On the tray-belt line highly-trained girls inspect the candies as they are packed. Then there are two inspections near the end of the line.

On the plain-belt line, top and bottom layers are looked over by roaming inspectors. And the top layer is again inspected at the brushing station.

The tray-belt system has these additional advantages:

1. It is extremely flexible, since it can be used to pack as few as 300 or 400 boxes and as many as 7,000 or 8,000 lb. boxes per 8-hr. shift, using up to 40 packers.

2. This line serves as a labor-pool for the plain-belt line. This is possible because any number of girls can pack on the tray-belt line whereas requirements on the plain-belt line limit the number of workers. Thus, if a worker on the straight-line belt is absent, she can be replaced by a girl from the tray-belt.

Here is a step-by-step account of the tray-belt operations:

In front of the two lines are stationary, wooden, stock bins, each with 90 compartments holding two cases of stock. These stock cases are 12 x 16 in. and they hold about 12 lb. of chocolates.

New Packing: Takes girl only a week

ON NEW LINE, boxes are conveyed by 150-ft.-long plastic belt past packers who handle only one type of chocolate. This system does not require high skill. It takes only a week for a new girl to "keep up." The two lines subsequently go to weighing, brushing and wrapping stations.

Two men feed the stock into the bins from the rear. And two girls remove stock from the front of the bins and load them into trays, two cases of the same variety of chocolates to a tray.

In addition to stocking the bins, the two men collect empty cases at the stocking station. Here, the empties are stacked on the floor, later to be placed on a conveyor going to the cleaning department.

Cases of stock are numbered to facilitate identifying each variety of chocolates, making it unnecessary to write out the name of the variety. For example, the "2" indicates "chocolate coated mints."

After the girls have filled the trays, the packing operation starts. As the belt moves along, girls picking a chocolate out of a case with their right hand, place it in a paper cup held in their left hand and set the piece in the proper position in a candy box, on an inclined table in front of them. Each girl must pick out six pieces of one kind of chocolate per stock tray before it passes her.

It takes the conveyor 23 min. to make a complete cycle. And each girl is expected to pack six 2-lb. boxes of chocolates in this time.

Time is allowed to transfer six packed boxes onto the 16-in. inspection belt running over the tray-belt. And there is also time to restock the packing table with empty box bottoms from a stationary shelf above the inspection belt. To make these changes, the tray belt is set up to allow empty trays to go past the packers. Empty box bottoms—as in the case of the Fairhill box—are already set up with double X forms that divide the bottom layer into seven sections.

After the bottom layer is packed, a tray on the conveyor delivers wax paper liners to the girls. Another carries chipboard liners, and a third supplies cardboard forms—a center and two end forms for dividing the top layer into five sections.

At this point, girls pack the top layer. Then the boxes ride along the top belt to a station where four girls (two on each side of the belt) inspect the top layer. Imperfect pieces are replaced, and any flaws in the box are corrected.

Leaving the inspection station, boxes go to the weigher. Then, the conveyor makes a right-angle turn, carrying the boxes to four other girls for a further inspection. Using a soft bristle brush, these girls also "polish" the top layer of chocolates.

Subsequently, two girls pack Jordan almonds and a special chocolate topping piece into the boxes. Then three girls add the folded guarantee inserts and put the lids on. Another girl feeds the closed boxes into a machine that overwraps them with heat-sealable cellophane. Farther along the line, an automatic machine puts a price label on each box. Finally, a girl packs three boxes into a chipboard container. And the finished goods are now chuted to the floor below, where they are cased.

New System Has Many Advantages

Now, about the new line: One advantage of this line is the little time required to train girls. It takes only a week for a new girl to learn to keep up with the belt, for all she has to do is pack one variety of chocolate into the proper place, in each box. But on the tray-belt line, it takes four to five months for a girl to become proficient. She must know the position in the box of each piece of candy and of the liners and dividers. And she must keep up with the belt while she packs six boxes at a time.

To eliminate congestion, lines are stocked with cases of the candy at night. Each girl then has an 8-hr. supply. As cases are emptied, they are loaded onto a center belt that carries them to the cleaning department, from where they are later returned to the enrobing department for refilling with finished chocolates.

At the carton-feeding station on each line, two girls open chipboard cartons each containing three empty 1-lb. candy boxes. Next, they separate box tops from bottoms. Bottoms are fed onto a 6-in. wide and 150-ft. long plastic belt that is fitted with wooden pegs that space the bottoms as they go to the packers. Then, the box tops and chipboard cartons ride along a top belt to the lidders and carton packers.

On the new packing line, a girl codes each bottom. Girls then pack chocolates in their proper places in the box, each girl handling only one specific piece of chocolate that goes into one specific place.

After the bottom layer is packed, a girl inserts a waxed paper liner. Another puts in a cardboard liner. And three girls place cardboard boats over the liners. Then, girls pack the top layer.

Five inspectors look over the top and bottom layers during the packing operation. Imperfect pieces are replaced, and flaws in packing are corrected.

Near the end of the line, a girl weighs the boxes. Then girls inspect the boxes and the top layers of the confections are automatically brushed to a high luster by a specially designed machine.

The next two girls pack Jordan almonds and chocolate topping into the boxes. Another girl puts a top liner and insert in the box. Two girls put on the top lids. Another feeds boxes into the carton-wrapping machine. Price labels and ingredient stickers are applied to the boxes by machine. Finally, the last girl packs three boxes into a chipboard container and chutes it to the finished goods storage department on the floor below.

An important feature of the Whitman chocolate packaging department is the air conditioning. This prevents development on the chocolate coating of bloom, which may occur if the temperature is high enough for the cocoa butter to melt and come to the surface. It also keeps the coating firm enough to avoid fingermarking of the candy.

Finishing Touches

FINAL STEPS are the same on plain- and tray-belt lines. Boxes of chocolates (rolling in from right) are weighed, brushed, inspected and wrapped.

COLOR of treated, sliced apples is being measured with Maxwell disks, based on Munsell color system.

ASCORBIC ACID (vitamin C) content of frozen apples is being determined with the Coleman spectrophotometer.

Browning of Frozen Apples Prevented

Sodium bisulphite treatment rated best. All others, except sodium chloride, were acceptable. Ascorbic acid and SO_2 were well retained in fruit

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Preserving the quality of sliced apples and keeping them like the fresh product can be achieved to a certain extent by freezing. But prefreezing treatment is necessary to prevent normal darkening.

Discoloration of the entire slice of apple takes place. And this condition makes it objectionable for use in the bakery trade. Darkening occurs not only during preparation, but continues slowly during freezing and 0 deg. F. storage.

How Some Chemicals React

To give the fruit correct prefreezing treatment, it is necessary to know how each variety responds to the different browning-prevention treatments. Senn and Bisno[1] believe that the sooner emphasis is placed upon definite standards acceptable to users, the greater will be the volume of frozen fruit sold.

A number of materials have been suggested to prevent discoloration in frozen apple slices. However, none has been universally adopted for one or more reasons. Sodium chloride will inactivate the oxidase enzyme system at low temperatures, but it will not bleach apples already discolored. Sulphurous acid, sodium bisulphite, and postassium metabisulphite can be used interchangeably to prevent fruits from browning. When in solution, these sulphur-containing compounds yield SO_2. Wiegand[2] reported that an SO_2 content of 50 to 100 ppm. in treated apples inhibited browning of the fresh and frozen fruit.

Ascorbic acid solutions prevent browning and loss of flavor in easily oxidized fruits. Sober[3] noted that a pH below 3.25 stabilized ascorbic acid and color in frozen fruits. Luther and Cragwell[4] reported that the addition of a suitable acid inactivated the enzymes involved in the destruction of natural and added ascorbic acid. But to be effective, these solutions must penetrate the fruit.

Apples Get Prefreezing Treatment

Jonathan apples, U. S. No. 1 grade, with a minimum diameter of 2¼ in., were used in this study. The apples had been in cold storage about two months before they were prepared for freezing. They were firm-ripe and well colored.

The fruit was peeled, trimmed and sliced into 12 pieces of equal size. A 1 percent sodium chloride solution was used to prevent browning while handling the fruit.

Apples were treated by the following methods before they were frozen:

1. *Control*—Samples were packaged and frozen: without additional treatment.
2. *Sodium chloride*—Treated samples were immersed in a 4 percent sodium chloride solution, under vacuum.
3. *Sulphur dioxide*—Treated sam-

ples were submerged in 0.1 percent sodium bisulphite or 0.5 percent potassium metabisulphite solutions. Apple slices were immersed in one of the solutions for 2 min., drained, and then held in a covered, enameled container for 5 hr. to permit penetration of the solution before packaging.

4. *Ascorbic acid*—Treated samples were dipped in a 0.08 percent solution of l-ascorbic acid or a 0.5 percent solution containing 4 percent ascorbic acid and 96 percent citric acid, under vacuum.

After the apple slices were given prefreezing treatment, slices sufficient for one 9-in. pie were packed in waxed 1-qt. paperboard tubs with slip-in lids, using 4 parts of fruit and 1 part of sugar. The slices were frozen at −40 deg. F. and held at 0 deg. F. (± 2 deg. F.) until ready for testing.

How Tests Were Made

Tests were conducted with apple slices before they were frozen and after they were frozen and stored 2, 5, 10, 15, 20 and 25 weeks. Sample slices were baked into pies for subjective scoring and color measurements. Analyses were made of ascorbic acid and sulphur dioxide contents of raw (uncooked) samples.

Before making the pies, the frozen fruit was defrosted in a household refrigerator (41 deg. F.) for 14 to 15 hours. Sugar and spices were omitted. Paper pie plates with metal rims were lined with pastry. Apples were arranged on the bottom crust, and the upper crust was placed over the fruit. Next, the edges of the crust were turned under and crimped. Three slits were cut in the top crust to permit the escape of air and steam. Finally, the pies were baked at 400 deg. F. for 65 min. and cooled about 3½ hr. before the pies were scored.

A scoring panel was made up of six members. There were six test periods of five days each. And lots of frozen apple slices given the six prefreezing treatments were baked into pies each day.

Pies were presented to the judges at random, and they were scored for color, consistency, odor, flavor, tenderness of fruit, texture of fruit, texture of lower crust, general conclusion and acceptability. Scores ranged from: 1—very poor, 2—poor, 3—fair, 4—medium, 5—good, 6—very good and 7—excellent. Judges were requested to record any comments concerning outstanding features.

Color of the baked fruit was measured objectively with Maxwell disks, based on the Munsell color system. Calculations were made according to methods given by Nickerson[5]. Four disks were used. They were neutrals N1/ and N5/ or N8/ and hues 5Y

Data Disclose Condition of Treated Apples

TABLE I—Of the Five Prefreezing Treatments Given to Sliced Apples, the Sodium Bisulphite One Came Out Best

Treatment	Weeks Held in Storage	Color	Consistency	Odor	Flavor	Tenderness of Fruit	Texture of Fruit	Crust Texture (lower)	General Conclusion
Fresh	0	5.7	5.6	5.8	5.4	5.7	5.5	4.1	5.3
None	2	3.7	5.1	4.6	4.2	4.8	5.0	4.2	4.4
	5	3.4	5.3	4.7	4.3	4.8	4.9	4.4	4.1
	10	3.8	5.4	4.8	4.7	5.0	5.0	4.9	4.5
	15	3.3	5.5	4.3	4.2	4.7	4.9	4.5	4.3
	20	3.4	5.1	4.8	4.0	4.2	4.7	4.5	3.9
	25	3.8	5.1	5.2	4.4	5.0	5.0	4.2	4.1
Sodium chloride	2	5.9	5.5	5.1	4.7	5.3	5.3	4.3	4.8
	5	5.4	4.8	5.3	3.9	4.7	4.7	4.5	4.0
	10	5.4	5.8	5.1	3.5	5.1	5.0	4.9	3.9
	15	5.6	5.9	5.4	3.2	4.6	4.7	4.8	3.9
	20	4.7	4.8	4.7	2.6	3.9	4.1	4.2	2.7
	25	4.6	4.1	4.5	2.7	3.8	4.1	4.3	3.0
Sodium bisulphite	2	5.0	5.5	4.9	4.9	5.3	5.3	4.2	4.9
	5	5.1	5.7	5.4	5.3	5.1	5.3	4.5	5.2
	10	5.1	5.7	5.1	4.7	5.1	5.1	4.6	4.9
	15	5.1	5.8	5.1	5.1	4.9	5.1	4.8	4.9
	20	4.3	5.4	4.5	4.3	4.7	4.7	4.5	4.1
	25	4.3	5.4	4.9	4.8	5.2	5.0	3.9	4.5
Sodium metabisulphite	2	5.8	5.3	5.4	5.1	5.1	5.1	4.3	5.0
	5	5.4	5.4	5.0	5.1	5.1	5.1	4.4	5.0
	10	4.8	5.0	4.9	4.5	4.7	4.6	4.8	4.4
	15	4.9	5.4	4.7	4.8	4.8	4.8	4.4	4.6
	20	4.8	5.5	4.8	4.5	4.5	4.6	4.4	4.2
	25	4.7	5.2	4.9	4.8	4.9	4.9	4.1	4.4
Ascorbic acid	2	5.9	3.8	5.2	5.1	5.5	5.2	3.5	4.7
	5	5.7	4.2	5.2	5.5	5.6	5.6	4.0	4.9
	10	5.2	3.8	5.1	5.3	5.5	5.6	3.9	4.8
	15	5.3	3.5	4.8	5.0	5.3	5.5	4.3	4.8
	20	4.8	3.0	5.2	4.9	5.2	5.2	4.2	4.5
	25	4.6	3.5	5.1	4.7	5.3	4.9	3.7	4.1
Ascorbic acid and citric acid	2	5.7	3.6	5.3	4.9	5.2	5.3	3.4	4.7
	5	5.5	4.0	5.5	5.3	5.6	5.8	4.1	5.0
	10	5.3	3.7	4.9	4.5	5.5	5.6	4.3	4.6
	15	5.4	3.9	4.9	4.9	5.5	5.7	4.6	4.9
	20	5.0	2.9	4.8	4.8	5.2	5.5	4.1	4.3
	25	4.8	3.2	5.1	4.4	5.4	5.2	3.8	4.1

TABLE II—Objective Color Data on Apple Slices From Baked Pies Show Sodium Bisulphite-Treated Apples Rated on a Par with Fresh Apples

Treatment	Weeks Held in Storage	Hue*	Value**	Chroma***
Fresh	0	20.58	7.02	9.36
None	2	17.59	4.94	5.58
	5	18.33	4.91	5.33
	10	19.61	5.49	5.21
	15	18.84	5.36	5.23
	20	18.56	5.16	4.32
	25	19.01	5.23	4.42
Sodium chloride	2	20.10	6.64	8.47
	5	18.89	5.88	7.66
	10	18.73	5.86	6.84
	15	19.77	6.03	6.50
	20	19.66	5.61	5.35
	25	20.07	5.79	5.42
Sodium bisulphite	2	20.57	6.63	8.21
	5	20.01	5.88	6.50
	10	19.60	5.85	6.00
	15	20.62	6.15	6.41
	20	20.44	5.86	5.16
	25	20.91	5.86	5.21
Potassium metabisulphite	2	23.36	7.12	8.35
	5	22.55	6.44	7.18
	10	22.29	6.44	6.53
	15	22.69	6.44	6.41
	20	22.68	6.26	5.69
	25	23.83	6.48	5.71
Ascorbic acid	2	22.51	6.98	8.33
	5	22.36	6.38	7.20
	10	21.82	6.37	6.58
	15	22.38	6.44	6.58
	20	21.81	6.11	5.74
	25	22.76	6.26	5.57
Ascorbic acid and citric acid	2	22.35	6.92	7.97
	5	21.01	6.24	7.22
	10	20.97	6.18	6.43
	15	21.83	6.24	6.10
	20	21.54	6.09	5.45
	25	21.59	6.03	5.28

* Hue of yellow-red is 15 and yellow is 25.
** Value runs from one (black) to ten (white).
*** Chroma is the strength of the color. The maximum chroma for yellow-red and yellow is 12.

TABLE III—Ascorbic Acid Content* of Treated and Untreated Raw, Frozen Apples

Weeks in Storage	Control Sample	Samples Treated With: Ascorbic Acid	Samples Treated With: Ascorbic Acid-Citric Acid
3	0.8	22.7	4.9
11	0.7	24.8	4.8
16	0.7	16.0	3.2
21	0.7	——	5.3
26	0.2	14.8	3.5

* Mg. per 100 g.

8/12 and 5YR 6/12. Results were expressed as hue, value and chroma. Hue is the name of a color—red, yellow, or blue. Value is the lightness or darkness of a color. And chroma is the strength or purity of a color.

Reduced ascorbic acid determinations were made on the frozen fruit by the method described by Loeffler and Ponting[6]. The SO_2 content of the frozen apple slices was determined according to the method of Ponting and Johnson[7].

What These Findings Revealed

1. Sodium bisulphite was best of the treatments used for the prevention of browning in frozen, sliced, Jonathan apples. All treatments tried, except sodium chloride, were acceptable. Prefreezing treatment was necessary to prevent browning.

2. Hue notations varied among treatments, but remained fairly constant during storage. Value and chroma scores declined during storage, indicating darkening and loss of color.

3. Retention of ascorbic acid and SO_2 in the frozen fruit was good.

Sodium Bisulphite Rated Best

Mean scores for the pies at each test period are shown in Table I.

Color: The fruit in control pies was dark brown and was scored the lowest. Apple slices treated with sodium chloride, ascorbic acid, and the ascorbic acid-citric acid combination were scored highest. Samples treated with sodium chloride had a pink cast; sodium bisulphite a brown tinge; and potassium metabisulphite a more yellow, bleached color. Color scores for fruit immersed in sodium chloride and ascorbic acid solution dropped the most during storage.

Consistency: Fruit dipped in ascorbic acid and ascorbic acid-citric acid solutions rated the lowest. There was an excessive amount of free juice in these pies. This high water content was attributed to the vacuum treatment. However, this juiciness might be corrected with a thickening agent. Untreated apples and those treated with sodium bisulphite and potassium metabisulphite were mushy and dry.

Odor: Judges did not comment on off-odors in the baked fruit. And they did not detect the odor of SO_2 in any of the samples. Differences in treatment had no effect on the odor of the fruit.

Flavor: Apple slices treated with ascorbic acid received the highest score. Fruit immersed in the ascorbic acid-citric acid solution was occasionally described as tart. Most judges frequently commented on the saltiness of slices treated with sodium chloride —the sample that dropped the most in the flavor score.

Tenderness of fruit: Samples treated with ascorbic acid and ascorbic acid-citric acid scored the highest. The sodium chloride-treated samples were the least tender. Judges described this fruit as dry, tough, and hard.

Texture of fruit: Apples dipped in ascorbic acid and ascorbic acid-citric acid solutions were the most desirable. Fruit treated with sodium chloride was coarse and disagreeable to the tongue. This coarseness may have been due to dehydration of fruit tissue by the salt.

Texture of lower crust: Scores for crust texture and consistency of the fruit followed the same pattern, an indication that the amount of liquid in the fruit had a direct influence on the texture of the lower crust.

Acceptability: Except for the control and sodium chloride-treated samples, all pies made from the frozen apple slices were acceptable. Control samples were unacceptable one day in the 5-week test period and one day in the 20-week period. Samples treated with sodium chloride were acceptable after two and five weeks' storage but became less acceptable each following test period.

In a nutshell, the scores showed that, on the average, apples treated with sodium bisulphite rated highest. Apples immersed in potassium metabisulphite, ascorbic acid and ascorbic acid-citric acid solutions were close seconds. Sodium chloride-treated apples scored the lowest.

What Color Tests Show

Notations from the objective color tests on the baked fruit are given in Table II. Fruit treated with sodium bisulphite had about the same hue as the fresh fruit, but the value was lower and not as much of the color was present. Apple slices immersed in a potassium metabisulphite solution were the yellowest, with slices treated with ascorbic acid being second, and those treated with ascorbic acid-citric acid rating third. Control samples had the least amount of yellow.

Figures for value show that control samples were darkest. Sodium metabisulphite, ascorbic acid and ascorbic acid-citric acid treated samples were lightest—all being nearly the same.

There was very little change in hue and value with the length of time in storage, but there was considerable change in chroma. The highest chroma was found in the fresh fruit. All of the frozen samples showed a decided decrease in chroma from the first time interval to the last. This shows there was a loss of color with storage.

Ascorbic Acid and SO_2 Retentions

Ascorbic acid determinations were made on the fruit treated with ascorbic acid and ascorbic acid-citric acid to measure vitamin C uptake and retention. The fruit receiving no treatment was used as a check. Data are shown in Table III.

Figures indicate very little reduced ascorbic acid in control samples. Ascorbic acid-treated apples contained about three and one half times as much ascorbic acid as those treated with ascorbic acid-citric acid. Ascorbic acid solution used for the prefreezing treatment contained four times as much ascorbic acid as the ascorbic acid-citric acid solution. The fluctuation in the figures for the treated fruit might be accounted for by variation in the amount of the solution absorbed by the fruit.

The SO_2 content of the fruit treated with sodium bisulphite and potassium metabisulphite was determined to find out how well SO_2 was retained in the fruit during storage.

Control samples contained no SO_2. Fruit treated with sodium bisulphite contained an average of 23 ppm. of SO_2 throughout the test period, compared to 108 ppm. of SO_2 in fruit treated with potassium metabisulphite. This difference in SO_2 content can be accounted for by the fact that the fruit was exposed to five times as much available SO_2 in the sample treated with potassium metabisulphite. From these figures it appears that the SO_2 was well retained during 0 deg. F. storage.

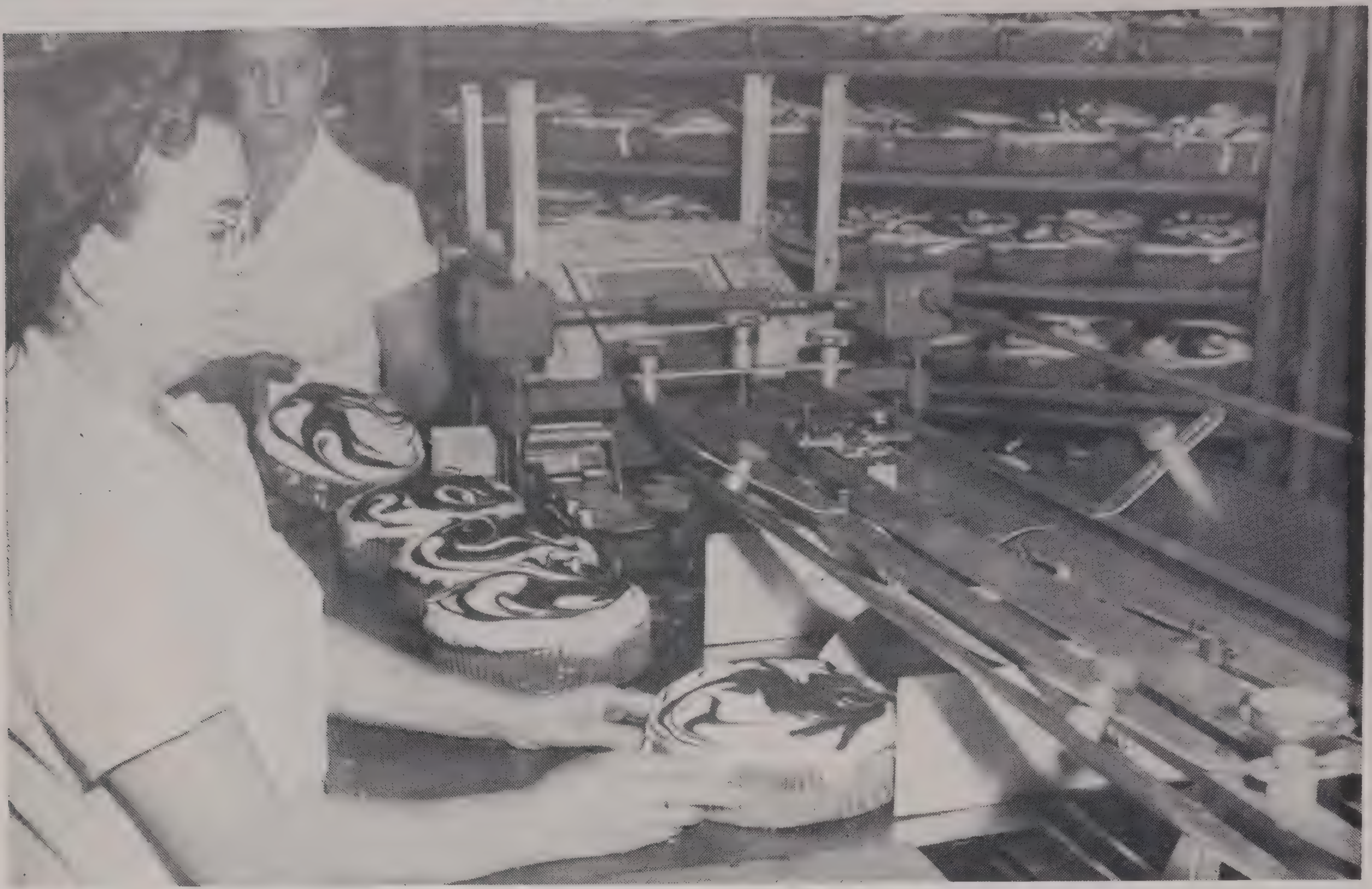
Findings Are Summarized

A study was made of five methods for preventing browning in frozen, sliced Jonathan apples used in pies. Fruit frozen without additional treatment after peeling and slicing was used as a control. Pies were made from the fresh fruit and from frozen apple slices after 2, 5, 10, 15, 20 and 25 weeks in 0 deg. F. storage. There were five replications in each test period.

Pies were scored subjectively for color, consistency, odor, flavor, tenderness of fruit, texture of fruit, texture of lower crust and general conclusion. The color was measured by the Munsell system, using a spinning-disk colorimeter. Raw fruit from the ap-

(*Turn to page* 196)

Speedy Unit Needs Only These 2 Girls to Carton Cakes



CAKES are pushed into cartons that have been automatically set up with front flaps open. Back flaps are closed.

Gets Bigger Output of Better

Baltimore bakery does it with special equipment that machine-opens and closes

JOHN V. ZIEMBA
Assistant Editor, "Food Industries"

Cost of labor for packaging pies and layer cakes has been cut nearly two-thirds and production increased over one-half since the recent installation of an automatic cartoning unit at Rice's Bakery in Baltimore. This new machine handles 1,800 to 2,400 packages an hour. It was developed by the bakery in cooperation with an equipment manufacturer.

In addition to lowering costs and increasing productivity, this bakery greatly improved its packages. By adopting a special, rigid cellophane-window carton, it has given new consumer convenience and improved display value. And it has banished the old film-overwrap and consequently the troublesome sticking of icing.

The present laminated, moistureproof carton was especially designed for easy opening and closing. To remove a pie or cake, the housewife merely pulls the top tear-flap and slides out the product. After a portion is consumed, the remainder may be replaced in the carton and the flap is tucked in.

Product visibility is attained with the new cellophane window, and there is now no need for an overwrap. Because the new window carton is rigid, icing does not contact, and stick to the cellophane.

Former Packaging Unsatisfactory

Before adopting the present method of packaging, the bakery went through two stages: First, these products were wrapped in cellophane by hand and then inserted into folding boxes to protect them during shipment and further handling. But this method had disadvantages: The cost of labor to package the goods was high, icing adhered to the cellophane, and the package afforded no product-visibility.

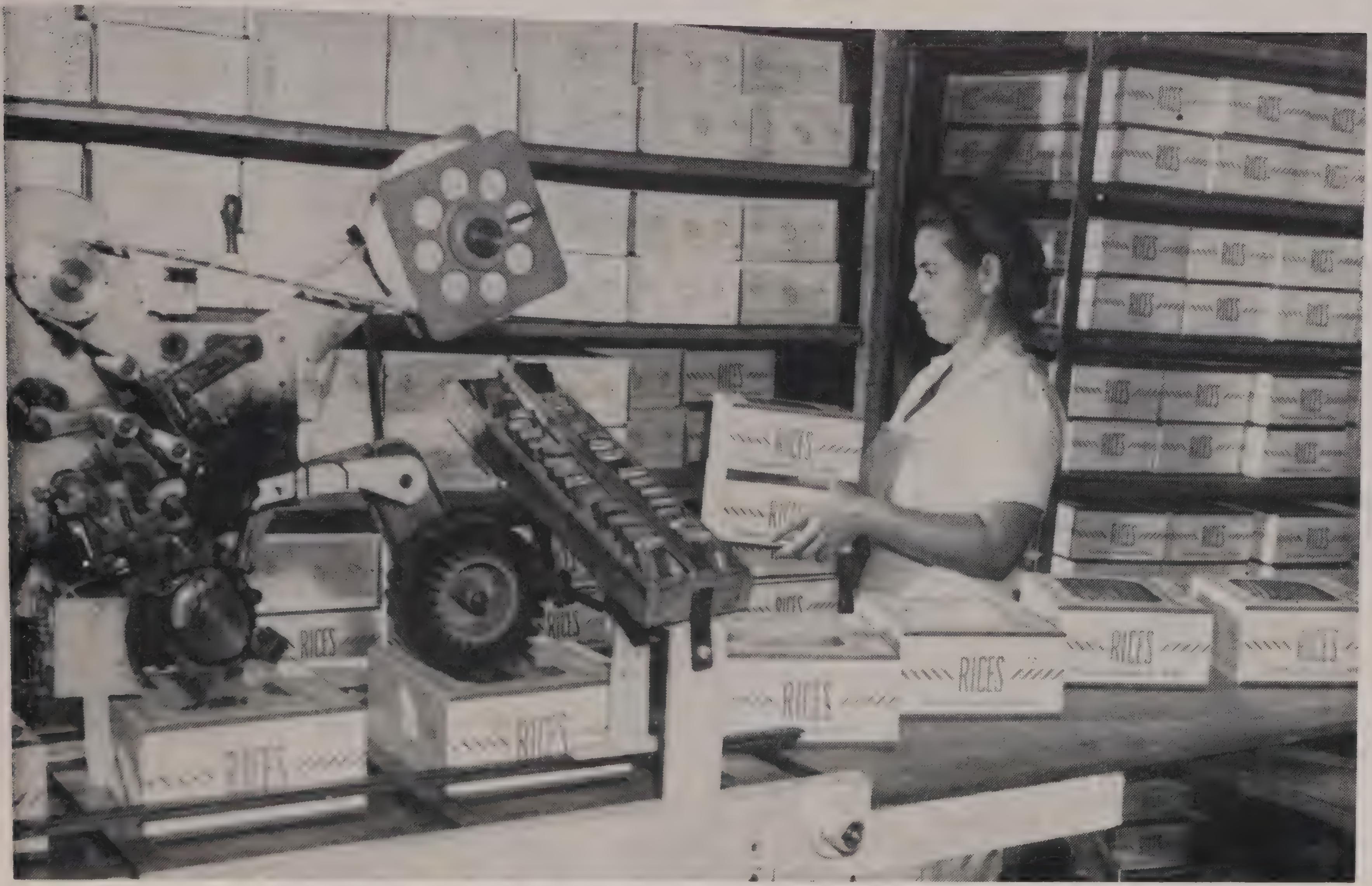
To get away from these objections, the bakery devised a second method: It packed pies and cakes into laminated, moistureproof cartons with windows and next machine-wrapped the cartons with heat-sealable cellophane. With this change, the packages gave visibility. Moreover, the amount of labor required to package the baked goods by this method was materially reduced.

Yet, this method also had drawbacks. The package could not be re-used after the cellophane was broken. And the cost of the package was out of line, because of the additional packaging material—the overwrap.

With this latter method of packaging, eight girls handled 1,200 packages per hour on one line. Three girls set up the cartons. Another three packed the product into them, closed the flaps, and placed the cartons on a canvas-belt conveyor. Finally, one girl fed them to a cellophane-wrapping machine and another loaded them onto racks.

By merely using the new cartoning machine and the special container, the

And Only This 1 Girl to Tend Labeling and Rack Boxes



AFTER FILLING and end-sealing, the labels go on (note rack of different type-plates) and boxes are then stacked.

Packages With Less Labor

improved, "non-stick" cartons, enabling reduction of crew from eight to three

aforesaid two-thirds reduction in labor costs and 50 percent up in production was effected. Instead of eight girls, the new way requires only three. Now one girl stocks the carton magazine and feeds pies or cakes from a rack onto the machine deadplate, where a second operator inserts them into cartons. Finally, a third girl loads the boxed goods onto racks.

Then—The New Way

But before the new method could be used satisfactorily, one important problem had to be solved. Briefly, something had to be done about the machine-jamming that was caused on occasions when the knocked-down cartons became bent. To overcome this, Marathon Corp., the manufacturer of the new cartons, ships each case of 200 cartons in layers of 50 with cardboard liners between the layers. This protective practice put a stop to the bending.

And now, here are the details on how the labor-saving machine works:

All operations are automatic, except for the insertion of the product into the cartons. Starting at one end with the stack of flat cartons, the machine automatically sets them up to receive the baked goods. Then, after the products are inserted, the cartons are automatically glued at both ends.

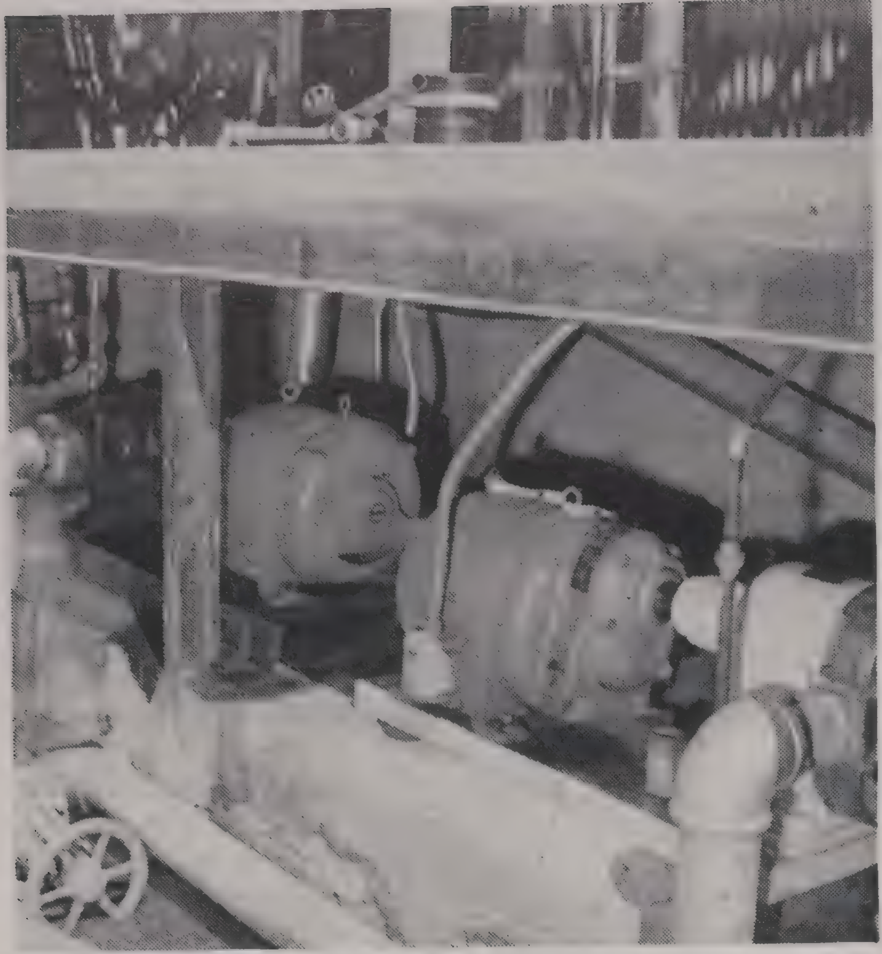
Filled cartons are then delivered to the machine's compression unit, where they are sealed. Finally, the cartons are conveyed to the other end, where another machine applies thermoplastic labels. These give the name of the product, its weight, and the price, also the ingredients used. Adjacent to the labeler is a box containing type-plates that can be selected for the different runs of products.

Two independent mechanisms comprise the automatic carton opener on the machine. These mechanisms, which consist of mechanical arms and a synchronized spring opener, assure proper setting up of the cartons. The arms break the folds and open the carton, while the spring opener assists the arms and serves to hold the carton open until the two small flaps on one end of the carton are automatically closed just before the product is inserted.

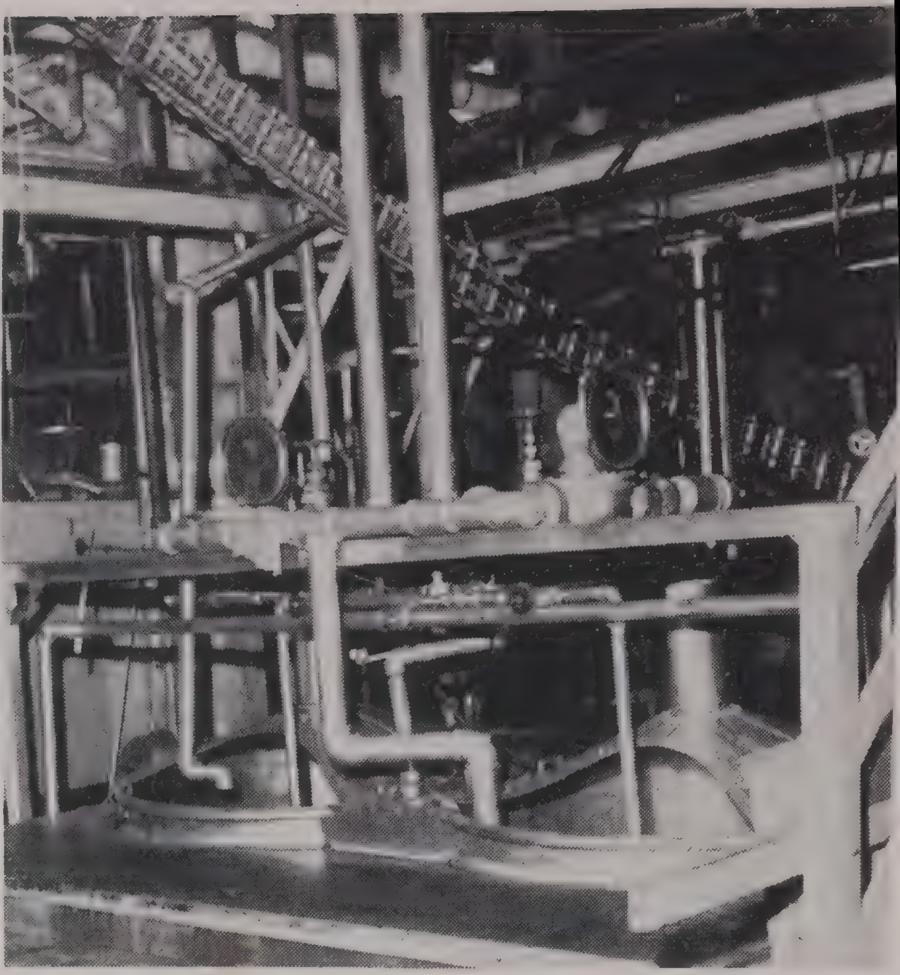
Thus, there is no possibility of the carton collapsing after it has been set up. The closed flaps also provide a firm stop for the product, which is inserted through the opposite end.

The cartoning unit, developed by Container Equipment Corp., can be quickly adjusted for three different sizes of cartons. There is one for cakes, which measures $4\frac{1}{4}$x$8\frac{1}{2}$x$8\frac{1}{2}$ in. and two for pies—the $1\frac{3}{4}$x8x8-in. size for fruit pies, and the $2\frac{3}{4}$x8x8 in. size for taller items like meringue, chiffon and Boston cream pies.

A future project of the bakery calls for further increasing production through the installation of two conveyors. One is planned for feeding the product from the cooling or icing stations to the automatic packaging machine, while the other will deliver the packaged goods to the shipping room.



ROTARY PLUNGER type pump (left) moves corn syrup, and sanitary pump (right) handles liquid sugar.



THESE AUTOMATIC proportioning meters measure syrups going into the mixing tanks through swing spout.

Liquid Ingredients Start Flow of Savings

Use of an economical corn syrup with liquid sugar enables canner to slash costs. Efficient pump system moves sweeteners, replacing expensive manual handling

RICHARD E. HEYL
Food Technologist, A. E. Staley Mfg. Co.

Dollar savings on ingredients and labor, and through increased production, have been effected by changing from the use of bagged sugar to a mixture of liquid sucrose and corn syrup as a sweetener in the cannery operations of Bercut-Richards Packing Co., Sacramento, Calif.

This switch from solid to liquid ingredients permits a notable new efficiency in materials handling. Semi-automatic pumping and blending equipment now handle the two liquids direct from the railroad tank cars to the mixing tanks.

Costs incurred in the use of the bagged, granulated sucrose as a sweetener for canned fruits had for a long time indicated a need for the mechanization of this sweetening phase of fruit canning. Besides the storage space and equipment needed, the labor cost for workers necessary for the handling and melting of dry sweeteners has steadily increased.

Following World War II, several large Western canners substituted liquid sugar for dry granulated by installing storage tanks, to which deliveries were made by tank trucks or cars. The resulting efficiencies and economies were of such magnitude that further research was instigated in the field of liquid sweeteners—to ascertain if even greater economies might be available.

After two years of investigation and tests, Bercut-Richards has installed, and successfully used during the recent fruit canning season, dual equipment for the mechanical handling of liquid sugar and an enzyme-converted corn syrup*.

Called "liquid corn" by the trade, this corn syrup has been used in a number of food products. It has been employed by Eastern canners since its development in 1939. However, the requirements of these plants were such that they had to secure their supply of liquid corn in drums, while a heavier requirement by the Western plants necessitated supply by tank car or tank trucks. And, because of the volume needed during fruit canning operations, it was necessary to mechanize the flow, blending, and cutting of these two syrups in order to assure an adequate supply.

How It's Handled

The company here concerned has extensive railroad trackage adjacent to its plant. Here, five or more tank cars may be spotted and syrups drawn direct from them into process. Being leased by the syrup suppliers, no demurrage charges accrue on the tank cars during the short time they are kept standing on the company's sidings.

At canneries where spur railroad tracks are in nearly continuous use, it is recommended that a storage tank of about 25,000 gal. capacity be installed. Then liquid sweeteners can be unloaded immediately upon arrival so that plant sidings are not tied up and positive control of syrup viscosity can be maintained.

Prior to the 1949 canning season, a dual-unloading system for sweetener handling was installed. (See sketch). This system provides five flexible steel hoses for connecting a combination of three tank cars of liquid sugar and two tank cars of liquid corn to the main unloading header. The syrups are kept separate until they are metered into the mixing tanks. Steam is used to heat the coils in the liquid corn tank car, reducing syrup viscosity and making pumping easier.

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* Sweetose, Reg. U. S. Pat. Off. made by A. E. Staley Mfg. Co., Decatur, Ill.

By a system of valves, any one or all five cars may be drawn from simultaneously. In case either of these syrups becomes unavailable by tank car, an emergency extension line under the railroad tracks to a road enables unloading from a tank truck.

From the discharge side of the two pumps, the syrups move through two 4-in., flanged galvanized pipes. To assure adequate flow and to compensate for unusually low temperatures that might occur during the canning season, the pipe carrying liquid corn is steam-traced so that it may be heated to lower syrup viscosity.

The syrups are pumped to two proportioning meters, where the full-time operator sets these automatic devices to deliver a predetermined amount of each to a single swing spout. As one of the two mixing tanks is filled, the swing spout is moved to the alternate tank and the pumping cycle repeated. The syrups in the first tank are mixed by steam agitation and diluted by the steam condensate to 60 deg. Brix. This blend is then pumped to the syrup cutting room for further dilution to the degree Brix required for the canning operation.

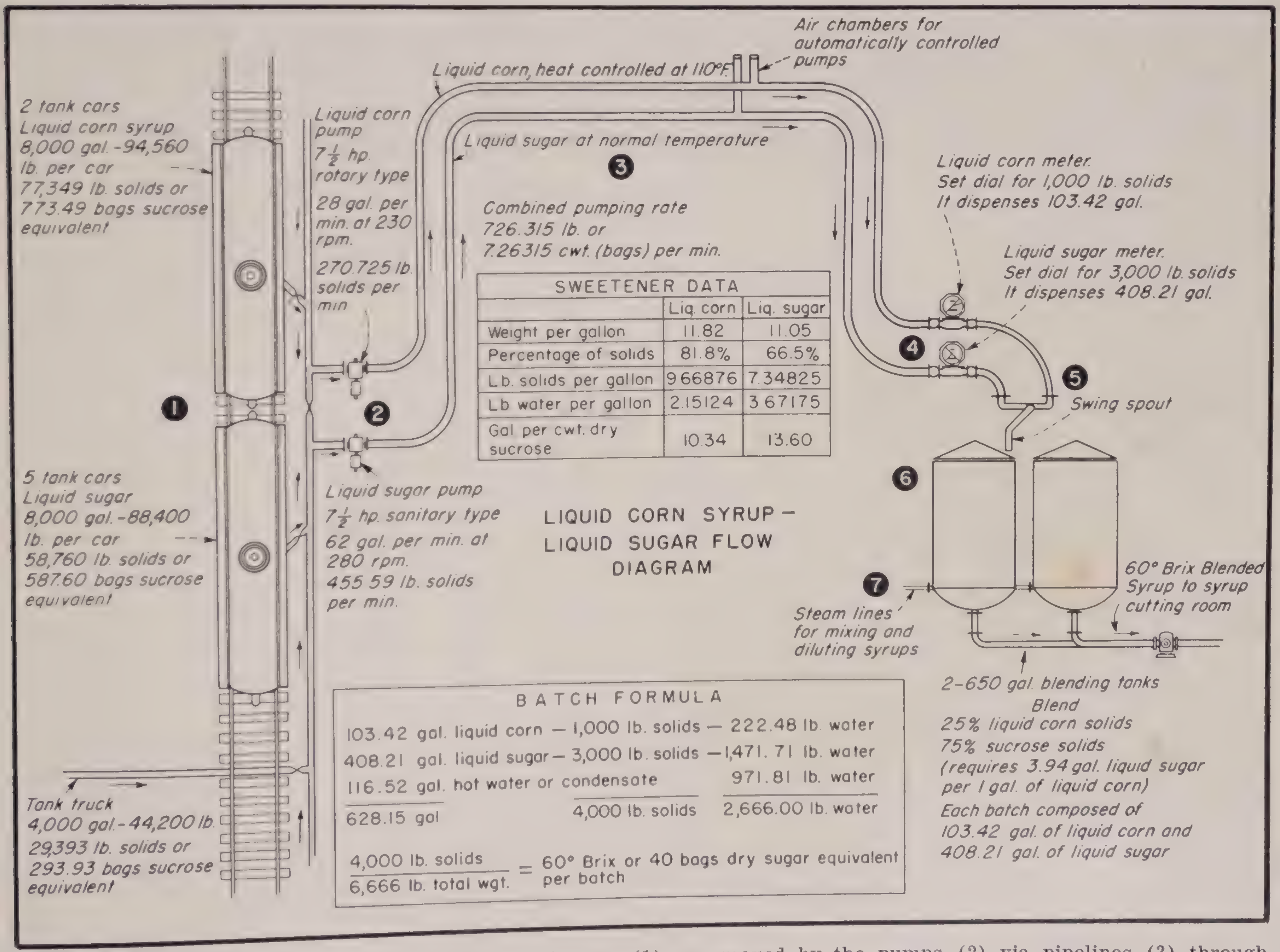
When this company used bagged, granulated sucrose, 27 min. were required for one cycle of dumping, melting, agitating, and pumping. But by using the dual liquid sweetener system, this cycle has been reduced to 9 min. for each 600 gal. mixed—a saving of 18 min. for each batch. On materials, savings of $1.30 a bag for all sucrose replaced by corn syrup were realized. Labor requirements have been reduced from a normal crew of at least five men and a peak-season crew of eight men to one full-time man to supervise all mixing at dump tanks and one part-time man to make tank car storage connections and arrange for movement of the tank cars.

Corn syrup is a broad term that covers numerous types of syrups derived from the hydrolysis of refined corn starch in the presence of water, hydrochloric acid, and heat. In general, there are four commercial classifications, which vary according to the dextrose equivalent (D.E.) or the total reducing sugar content calculated as dextrose on a dry basis. These commercial classifications are listed below:

Type of Corn Sirup	Approx. D. E.	Total Solids (43° Bé.)
1. Low conversion	28–33	79.5%
2. Medium conversion	40–42	80.3%
3. High-acid conversion	52–57	81.0%
4. High-enzyme conversion	62–65	81.8%

Low conversion corn syrup is not suitable for fruit canning because it lacks sweetness and has a high viscosity. Under some conditions, medium conversion corn syrup is satisfactory. High-acid conversion corn syrup is very satisfactory, but it is subject to development of a bitter flavor (hydrol) and possibility of crystallization of dextrose when the acid-conversion is carried too far. High-enzyme converted corn syrup has the greatest sweetness and the least viscosity (a

The Sequence


Air chambers for automatically controlled pumps
Liquid corn, heat controlled at 110°F.
Liquid sugar at normal temperature
2 tank cars
Liquid corn syrup
8,000 gal.-94,560 lb. per car
77,349 lb. solids or 773.49 bags sucrose equivalent
Liquid corn pump
7½ hp. rotary type
28 gal. per min. at 230 rpm.
270.725 lb. solids per min
Combined pumping rate
726.315 lb. or
7.26315 cwt. (bags) per min.
Liquid corn meter.
Set dial for 1,000 lb. solids
It dispenses 103.42 gal.
Liquid sugar meter.
Set dial for 3,000 lb. solids
It dispenses 408.21 gal.
Swing spout
1
2
3
4
5
6
7
5 tank cars
Liquid sugar
8,000 gal.-88,400 lb. per car
58,760 lb. solids or 587.60 bags sucrose equivalent
Liquid sugar pump
7½ hp. sanitary type
62 gal. per min. at 280 rpm.
455.59 lb. solids per min.
LIQUID CORN SYRUP — LIQUID SUGAR FLOW DIAGRAM
Steam lines for mixing and diluting syrups
60° Brix Blended Syrup to syrup cutting room
2-650 gal. blending tanks
Tank truck
4,000 gal.-44,200 lb.
29,393 lb. solids or 293.93 bags sucrose equivalent
Blend
25% liquid corn solids
75% sucrose solids
(requires 3.94 gal. liquid sugar per 1 gal. of liquid corn)
Each batch composed of 103.42 gal. of liquid corn and 408.21 gal. of liquid sugar

SWEETENER DATA

	Liq. corn	Liq. sugar
Weight per gallon	11.82	11.05
Percentage of solids	81.8%	66.5%
Lb. solids per gallon	9.66876	7.34825
Lb. water per gallon	2.15124	3.67175
Gal per cwt. dry sucrose	10.34	13.60

BATCH FORMULA

103.42 gal. liquid corn — 1,000 lb. solids — 222.48 lb. water
408.21 gal. liquid sugar — 3,000 lb. solids — 1,471.71 lb. water
116.52 gal. hot water or condensate 971.81 lb. water
628.15 gal 4,000 lb. solids 2,666.00 lb. water

$\frac{4,000 \text{ lb. solids}}{6,666 \text{ lb. total wgt.}}$ = 60° Brix or 40 bags dry sugar equivalent per batch

LIQUID corn syrup and sugar from railroad tank cars (1) are moved by the pumps (2) via pipelines (3) through automatic proportioning meters (4) and a swing spout (5) to mixing tanks (6). Here, steam (7) is employed to blend, and its condensate serves to reduce the heavy concentration of syrups.

factor in pumping). From a flavor standpoint, when blended with sucrose in the proportion of 25 percent (in accordance with Food & Drug standards), it produces an excellent syrup for packing all canned fruits.

Economics Cited

Cost of an installation for handling liquid corn will vary according to the amount of liquid sweetener required, the location of the plant, and the equipment necessary for storage and for moving syrups into process. Canners with a relatively high sugar usage will not only amortize the cost of an installation during the first year of operation, but will also show a substantial saving.

The savings may be grouped into three main categories: Ingredients, or cost of sweetening material; manpower; and miscellaneous, or inplant savings.

Ingredient Cost. During the 1949 fruit canning season, the costs of sweeteners at San Francisco were:

For refined sucrose, $7.90 cwt.; liquid sugar, $7.83 cwt.; corn syrup, $5.41 cwt.; and dextrose, $6.40 cwt.

The above sweetening-ingredient costs may be confusing to one not familiar with the total solids content of each sweetener, and the sales methods used by the cane and beet sugar manufacturers and the corn refiners.

Liquid corn is sold on f.o.b. plant basis, and the delivered price, which includes the freight, is the same at all points on the West Coast. Sucrose is sold on the basing point system, and has a freight charge beyond the basing point. Dextrose is sold at a flat differential under cane.

Provisions of the Federal standards for canned fruit must be considered in calculating sweetening ingredient cost. They permit ¼ liquid corn with ¾ sucrose, or 1/3 dextrose with 2/3 sucrose, all on a solids basis.

Manpower savings. These derive from the substitution of mechanical operation for manual labor. Our accompanying table shows a comparison of various systems of sweetener handling. A careful appraisal indicates that an average factor of 15c. will cover all elements of cost in handling a 100-lb. bag of sucrose or dextrose, and a cost factor of about ¾c. per cwt. of solids will account for power and all labor costs for handling the liquids.

These elements include unloading, movement to storage, storage rental, movement to process, unloading at process, cutting, dumping, spillage, melting, storing, empty bag accounting and disposal, and all labor incidental.

Miscellaneous. The table can be used by any canner having a plant near San Francisco to determine the savings to be expected, based on various combinations of sweetener usage. As an example, a canner with an annual requirement of 50,000 bags of granulated sucrose, located approximately 50 mi. from San Francisco, can refer to the comparisons in Section 3 of the table and determine the combined cost of sweeteners available to him. Reference to Section 6 will give approximate total costs, including handling, enabling him to estimate his expected savings.

The most economical combination listed is liquid corn and liquid sugar. The canner's potential savings are $545.40 for each 1,000 bags of sweetener solids required. His expected season savings would be 50 x $545.40, or $27,270.00. On the assumption that a reasonable estimate of the cost of a liquid corn and liquid sugar installation would be approximately $12,000, this canner's net savings for the first year of operation would be $27,270 minus $12,000, or $15,270. Thus, the cost of the installation would be amortized, and $15,270 saved the first year.

In addition to the method of handling liquid corn at the plant described above, some full-scale cannery operators this season used an entirely new automatic proportioning and blending apparatus that made it possible to blend liquid corn and liquid sugar at the storage tanks. The blend was then pumped through a single pipe line to the cutting room. The information obtained from these pioneer installations will be used in engineering designs for future sweetener system installations.

Any Concentration—Instantly

Moreover, automatic syrup cutting equipment has been developed which will enable the fruit canner to obtain instantly any degree of syrup concentration he desires. In the cannery of tomorrow, instead of the "dump tank" and the "cutting tanks" currently used, automatic gravity control equipment, located at each can filler, will blend liquid sweeteners and water to the desired grades.

Limitation of the supply of liquid corn will govern extent of usage. Since production of corn syrup is concentrated in the Midwest corn belt, western canners also have the problem of transportation, which is considerably more complex than for locally produced liquid sugar.

However, with adequate storage facilities at the cannery, and with a fair estimate of the canner's seasonal requirements, the corn processor will be able to deliver liquid corn promptly at the time specified.

The Facts

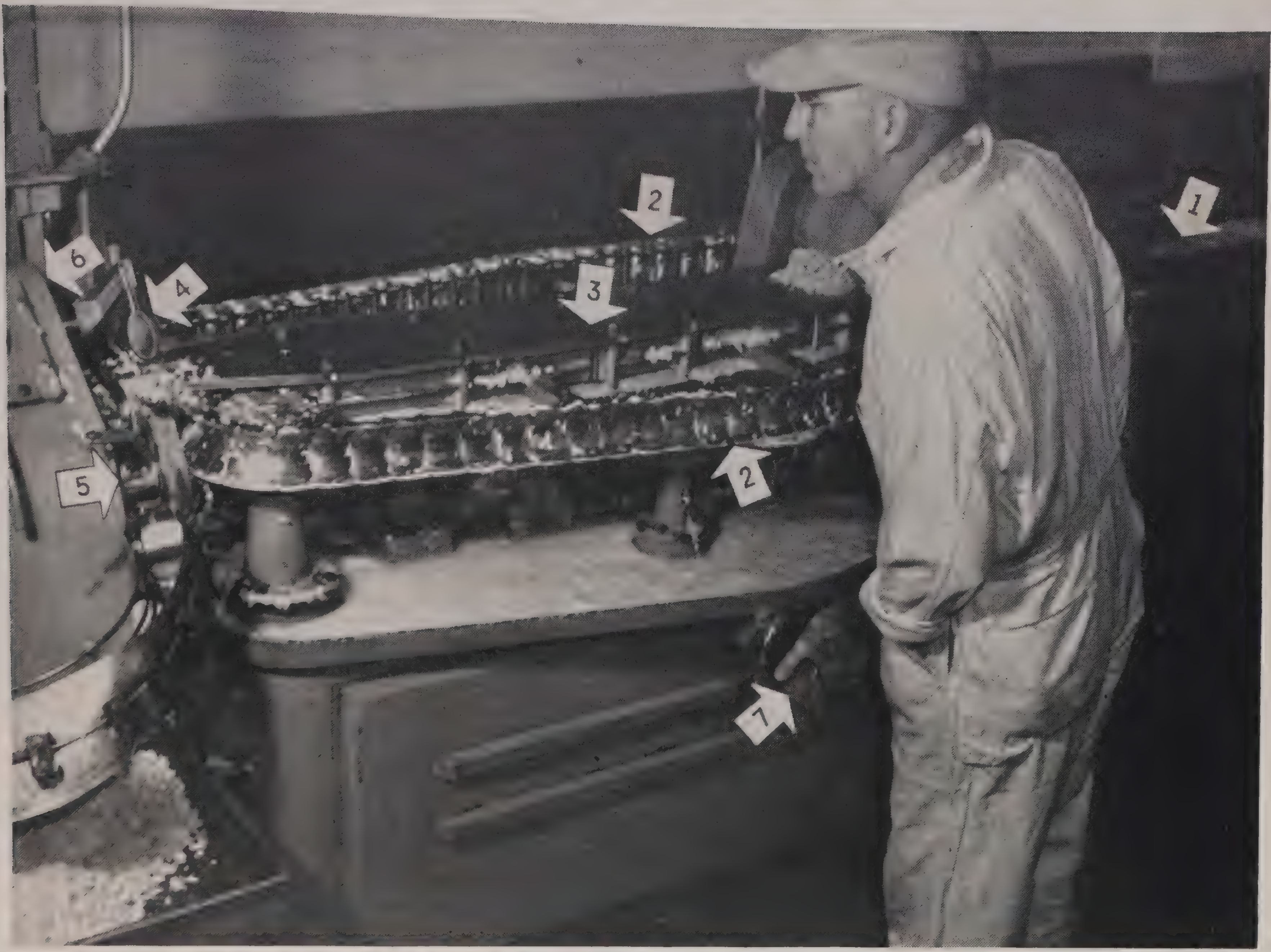
TABLE—COST COMPARISON of Sweeteners for Canned Fruit (West Coast 1949 Packing Season)

	Location		
Factors	**San Francisco**	**50-Mi. Radius**	**100-Mi. Radius**
1. Price Per CWT. of Sweetener On Commercial Basis:			
Refined sucrose	$7.9000	$8.0100	$8.1650
Liquid sugar	7.8300	7.9400	8.0950
Liquid corn (81.8% T. S.*)	5.4100	5.4100	5.4100
Dextrose (92% T. S.*)	6.4000	6.5100	6.6650
2. Price Per CWT. of Sweetener Solids Delivered:			
Refined sucrose	7.9000	8.0100	8.1650
Liquid sugar	7.8300	7.9400	8.0950
Liquid corn	6.6073	6.6073	6.6073
Dextrose	6.9565	7.0739	7.2445
3. Cost Per CWT. of Sweetener Solids in Canning Syrups in Canner's Plant:			
Refined sucrose	7.9000	8.0100	8.3150
Liquid sugar	7.8300	7.9400	8.0950
25% liq. corn + 75% refined sucrose	7.5768	7.6593	7.7755
33 1/3% dextrose + 66 2/3% refined sucrose	7.5855	7.6979	7.8582
25% liq. corn + 75% liq. sugar	7.5243	7.6068	7.7231
33 1/3% dextrose + 66 2/3% liq. sugar	7.5388	7.7013	7.8115
4. Cost Per CWT., Including Handling Costs, of Sweetener Solids in Canning Syrups in Canner's Plant;**			
Refined sucrose	8.0500	8.1600	8.3150
Liquid sugar	7.8378	7.9478	8.1028
25% liq. corn + 75% refined sucrose	7.6913	7.7738	7.8900
33 1/3% dextrose + 66 2/3% refined sucrose	7.7355	7.8479	8.0081
25% liq. corn + 75% liq. sugar	7.5321	7.6146	7.7309
33 1/3% dextrose + 66 2/3% liq. sugar	7.5940	7.7065	7.8667
5. Total Cost, Including Handling Costs, of Sweeteners Per Per 1,000 CWT. (Bag) Units:**			
Refined sucrose	8,050.00	8,160.00	8,315.00
Liquid sugar	7,837.80	7,947.80	8,102.80
25% liq. corn + 75% refined sucrose	7,691.30	7,773.80	7,890.00
33 1/3% dextrose + 66 2/3% refined sucrose	7,735.50	7,847.90	8,008.10
25% liq. corn + 75% liq. sugar	7,532.10	7,614.60	7,730.90
33 1/3% dextrose + 66 2/3% liq. sugar	7,594.00	7,706.50	7,866.70
6. Comparison of Savings Per 1,000 CWT. (Bag) Units, With Handling Costs Figured In, Using;**			
Liq. sugar instead of ref. sugar	212.20	212.20	212.20
Liq. corn + ref. sucrose instead of ref. sucrose	358.70	386.20	425.00
Liq. corn + liq. sugar instead of ref. sucrose	517.90	545.40	584.10
Liq. corn + liq. sugar instead of dex. + ref. sucrose	203.40	233.30	277.20
Liq. corn + liq. sugar instead of dex. & liq. sugar	61.90	91.90	135.80
Liq. corn + liq. sugar instead of liq. sugar	305.70	333.20	371.90
Dextrose + ref. sucrose instead of ref. sucrose	314.50	312.10	306.90
Dextrose + liq. sugar instead of ref. sucrose	456.00	453.50	448.30
Dextrose + liq. sugar instead of liq. sugar	243.80	241.30	246.10

* Total solids.

** Handling costs of $0.15 per bag of dry sweetener, and of $0.0078 per cwt. of sweetener solids in liquid corn and liquid sugar.

60 Times Faster



HERE is the new automatic machine, with its component parts indicated by arrows. (1) Feed conveyor, (2) precision stainless steel molding chain, (3) chain-formed "tunnel" (under cover plate) where cylinder of tuna is shaped and fed forward, (4) knife which cuts and moves severed pieces into cans, (5) gooseneck down which filled cans roll, (6) enclosed unit in which are combined knife actuating and can-indexing mechanism, and (7) speed controller by which operator adjusts over-under weight of cut pieces. Unit fills either 7-oz. or $\frac{1}{4}$-lb. cans.

Machine Forms, Cuts, Puts Tuna In Cans

Eliminating hand-packing department, it fills as many cans in a minute as a skilled manual worker turned out in an hour

C. R. HAVIGHORST

Associate Editor, "Food Industries"

Slow and laborious work of hand-packing tuna in cans is eliminated by a new machine now in successful operation at The Columbia River Packers Assn., Astoria, Ore. Several other tuna canneries on the Pacific Coast have also adopted the equipment.

Known as the "Pak-Shaper", the device has been hailed as the most significant engineering advance in the tuna canning industry in years. In operation, the new machine automatically molds tuna loins into a cylindrical shape, then accurately cuts off pieces to correct weight and moves them into cans. The unit is constructed to fill either 7-oz. or $\frac{1}{4}$-lb. cans.

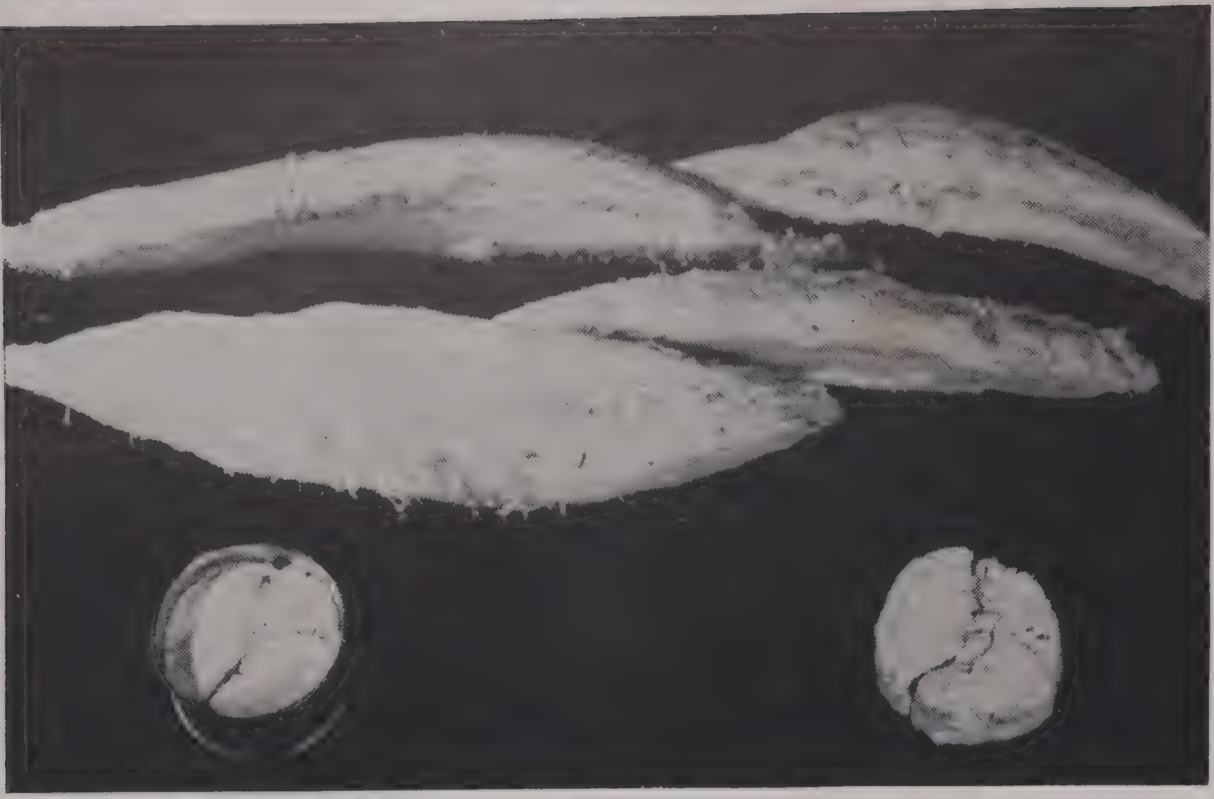
It does the work of about 50 hand-packers, accounting for savings of hundreds of dollars per day in operating costs.

Saves Tuna

What's more, its precision controls enable regulation of cut-weights within $\frac{1}{8}$ oz. With such a precise weight tolerance, as compared to the common over- and under-weights in hand-packing, the savings in this expensive fish product are notable.

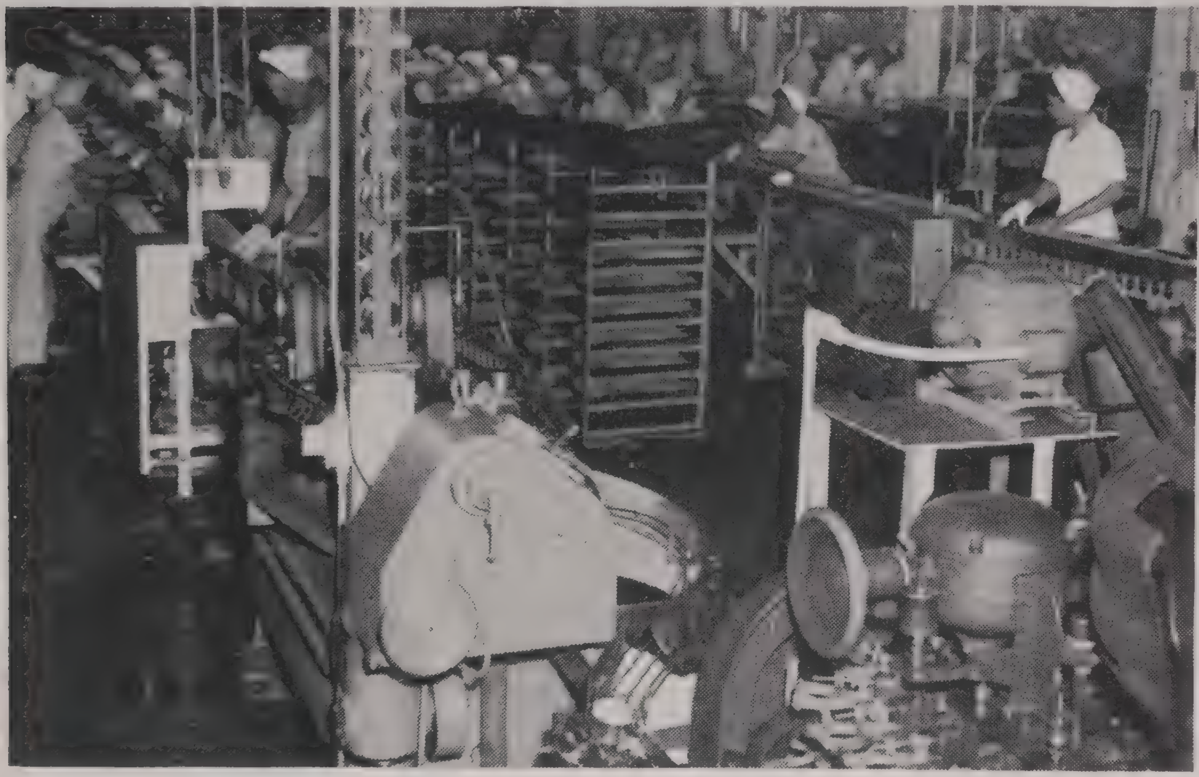
After tuna are precooked, workers remove the two loins from the sides of the fish and scrape them free of any adhering dark meat. With the exception of tuna livers and a small pack of combined white and dark meat, the recovery from the raw product is limited to the loins and represents about 45 percent of the weight of the raw fish. In view of this limited recovery of a high priced raw product, extreme care is used to conserve all of these portions of the fish.

Formerly, tuna loins were first arranged on wooden trays, then moved,



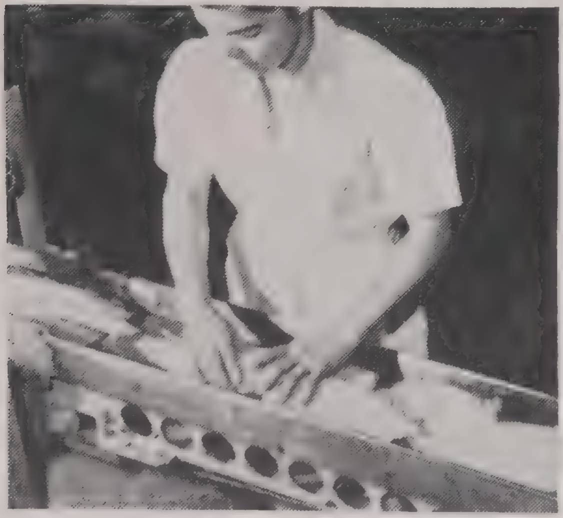
Whole Loins, Cut Section, and Canned Product

FOUR CLEANED loins (albacore), a section of tuna cylinder severed by knife, and a section as placed in a can. Loin size varies with tuna species.



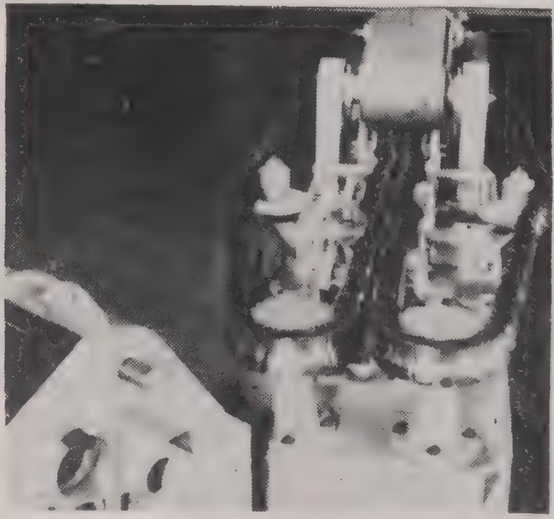
Three Lines In Action

WORKERS (background), on separate lines, clean and place tuna loins on conveyors leading to automatic cutting and packing machines (one is in foreground). At end of each preparation line, a single worker handles feeding of tuna loins into the automatic unit.



Feeding Closeup

HOW operator arranges tuna loins being conveyed into forming-chains.



Cleaning Features

FOR WASHING, filling unit swings aside and chain cover comes off.

by a conveyor, under an automatically operated knife, the "guillotine," which cut them into proper widths for packing into cans by hand. These trays then were conveyed to the hand-packers, each of whom filled from 120 to 130 cans per hour, depending on her skill and the sizes of the loins. These filled cans moved through the same finishing process as that which now follows packing with the new machine.

Elimination of the old wooden trays and the guillotine brings the cannery operator further savings—in maintenance and replacement and sanitation.

How It Works

The "Pak-Shaper," manufactured by E. H. Carruthers Co., Warrenton, Ore., needs only two operators and will pack up to 130 cans of tuna per minute, the equivalent of a skilled hand-packer's hourly total.

From the cleaning tables, the tuna loins move, by conveyor, to the operator who feeds the machine. This worker arranges the loins on a feeding conveyor in a manner most suitable for acceptance by the machine for forming the cylindrical section. Then the loins move automatically into the shaping chains.

These two endless-type stainless steel shaping chains, held by adjustable guides, are arranged in elliptical form on the machine, coming together to form a moving "tunnel" carrying the tuna loins. As the fish is moved toward the cutting knife, guides bearing on the chains apply pressure to form a solid cylinder of fish. The latter guides, which are adjustable, press alternately against the sides of the chains, thus facilitating the mechanical forming of the fish cylinder.

Weight Is Controlled

At the exit end of the chains, the cylinder is cut into the proper-weight widths by an automatically operated knife, which also ejects the severed piece into a can that has been positioned to accept it. The filled can then slides down a goose-neck and onto a conveyor, which carries it on for final processing.

Over- or under-weights can be easily and accurately corrected by the operator of the machine. He has only to turn an adjusting wheel which, through a variable control, makes a slight change in the speed of the forming-chains relative to speed of the knife and the can positioning mechanism. Usually this adjustment is made to compensate for factors such as a change in density of the fish or moisture content, which would result in inaccurate weights. In this instance, where an expensive fish is being handled, control of packing weights is of prime importance.

Seabrook Farms
GREEN BEANS
CUT CORN
BONUS
FROZEN Fresh
SPINACH
Seabrook Farms
GROCERIES
7up
MEATS

INTERCHANGE of views between plant man and retailer brought both goodwill and more effective selling.

Plant Men "Double" in Product Promotion

Taking to road in "off-season," they make goodwill calls at retail outlets—ironing out a lot of uncertainties on both sides

HOW to hold the nucleus of your production force through the "off-season" is an old problem in the food industry. And so is effective promotion of your food products. Seabrook Farms bound these two problems together last winter and came up with what looks very much like a solution to both.

Seabrook's season starts in late April, when asparagus begins to grow, and lasts fairly steadily over the summer and late into the fall with spinach and broccoli. Last year, its plant was just winding up its packing on December 15.

Production facilities at the Farms were expanded considerably during the war. Winter months were no more slack than the hot-and-heavy June pea season, since dehydration of root vegetables filled in the gap until the next crops of green vegetables were ready to harvest. Additional construction in the 1946-47 and 1947-48 winters gave employment to large numbers. But the pace was beginning to slow down, and prospects for 1948-49 indicated lean employment.

It was well along in the fall after other ideas had been thrashed out and discarded that C. F. Seabrook, the organization's president, came up with his plan.

"Send the plant men out on the road to make a goodwill tour of our retail outlets," Seabrook suggested. "Let them go out and tell about the farms and plant where our frozen foods are produced. And I have a hunch that seeing what happens to the product from the time it leaves their hands until it reaches the consumer will make better production men of them."

Short Promotion Course

Seizing on the plan, the Seabrook Farms sales staff undertook the development work, including a ten-day briefing course to familiarize the neophyte sales promotion men with the sales, advertising and merchandising programs. Distributors assisted in drawing up route maps similar to those used by their own salesmen. With 57 men available for this project, it was decided to detail the personnel in teams of ten, with a captain to supervise each. The five men selected as captains were sent on a test tour in Baltimore to gain information on reaction of the grocers to such a program. By the first week in January, the five teams were on the road.

The initial reaction can best be summed up by Tom Seracino, manager of a warehouse crew during production season and one of the team captains:

"The grocers I saw were extremely interested in knowing how frozen foods were grown and processed and asked a great many questions. All other men in my group had the same experience."

With the way prepared for the crews by spot radio announcements explaining the mission of the "Man From Seabrook Farms," the grocers' enthusiastic reception topped 95 percent. "The man" rolled up his sleeves, cleaned and scraped the freezer cabinets, and rearranged the merchandise. When he had completed this task, he offered to place point-of-sale advertising pieces, such as window streamers, price posters, decalcomanias, and the like, where they would aid in calling customer attention to the frozen foods. All the while, he answered questions about production, both from grocers

(*Turn to page* 198)

RUSKIN
SWEET CORN
FRESH
NER
ASTE

RESEARCH on prepackaged sweet corn was conducted in a mechanized plant operated right on a Florida farm.

USDA Looks at Food Marketing

Report reveals progress in food distribution studies. All aspects covered, from processing through packaging, transportation, warehousing and retailing

P. V. CARDON

Research Administrator, U. S. Department of Agriculture, Washington, D. C.

What has been done during the past year or so to help this country's privately operated marketing system to get farm products distributed to consumers in better condition and at less cost?

That question leads straight to one of the main objectives of the Research & Marketing Act. Federal funds, many of them matched 50-50 with state funds, are being used to do this job, so anyone has a right to ask for a progress report. I am glad to report on some representative results, with the hope that the fullest possible use will be made of them.

The following paragraphs discuss work completed or under way on prepackaging, grades and standards, better equipment, transportation, market expansion, and so forth.

Prepackaging is a relatively new, but already large and rapidly growing industry. So fast has been its growth that the industry has not been able to answer all the questions that have come up.

Results are in on one study of prepackaging and marketing of sweet corn in consumer-size packages. Experimental work was done on the Paul B. Dickman Farms at Ruskin, Fla., where 300 acres of Ioana, Golden Cross Bantam, and Golden Security corn were grown last year. In a plant operated right on the farm, the corn was husked mechanically, trimmed to 3- or 5-in. lengths, cooled to 45 deg. F. or colder, three large or five small pieces put in cardboard trays and wrapped with cellophane, then cooled again, and 800,000 such packages trucked to 200 cities east of the Mississippi.

Mechanical cooling units in trucks proved to be more satisfactory than ice bunkers because the mechanical equipment was able to maintain the necessary lower temperature on the road. Tests showed, however, that refrigeration before shipment was all-important, because the temperature of a truck load of prepackaged corn could be lowered very little while enroute with the types of equipment tried.

Higher Retail Profit

The marketing phase of the study in retail stores showed that there is more profit in handling prepackaged sweet corn than in the bulk product in the husk. The average final gross margin was 19.1 percent of sales value for prepackaged corn, 13.6 percent for bulk corn. Direct retail labor costs were about 3c. per sales dollar lower and spoilage losses about 10c. lower for the prepackaged than for the bulk. A survey of stores in New York, Baltimore, Washington, and Atlanta showed that retail sales per man-hour averaged about $102 for the prepackaged product, $16 for the bulk.

In some 50,000 of the 800,000 packages involved in this study, a postcard questionnaire was enclosed for the purpose of checking on general consumer reaction. Returns so far show that housewives are well pleased with the flavor, ease of preparation, visibility, lack of waste, cleanness, and convenience of prepackaged sweet corn. A more detailed report of this study is available from the Department's office of information.

Other Packaging Projects

Under another project, progress has been made toward improving the packaging of dry beans, peas, and rice. Shelf breakage, color deterioration, insect infestation, and mold caused by excessive moisture and heat are problems this study is trying to solve. One phase of this work has disclosed that there is a confusing variety of container sizes for dry beans, peas, and rice, particularly in the less-than-1 lb. packages. Housewives express dissatisfaction at buying what they assume to be 1 lb. packages of these commodities only to learn later that they contain somewhere between 12 and 15 oz. It would seem that the elimination of some of these intermediate-size packages would result in savings to packagers and less overhead and inventory investment for wholesalers and retailers. And it certainly would be a break for the household shopper.

Department scientists have discovered a chemical treatment that successfully keeps insects from getting into cotton bags. The process consists of impregnating the bags with a solution containing extremely small quantities of pyrethrins or mixtures of pyrethrins with piperonyl butoxide, which are unlikely to contaminate the contents. The specific purpose is to prevent insect damage to stored grains, cereal products, and seed stocks. Effectiveness of the treatment was tested by exposing treated and untreated bags full of insect-free flour in a heavily populated insect testing room. After seven months, no insects at all were found in the treated bags. There were 563 in the untreated bags.

Quality improvement is the goal of another RMA project in which Department entomologists are trying to discover how to prevent insects and insect debris from getting into processed fruits and vegetables. First efforts in this work are aimed at developing methods of removing the European corn borer from sweet corn at the cannery; removing aphids, caterpillars, etc., from broccoli, spinach, and other leafy vegetables; preventing contamination of canned peaches and tomatoes in Colorado by vinegar gnats; and, in the South, preventing contamination of canned black-eye peas by cowpea curculio.

Look to New Standards

There seems to be a general agreement that new and revised standards for grades should be worked out for processed fruits and vegetables. On the basis of data obtained so far in this broad field of work, the grades for green and wax beans, various citrus products, fruit jam and preserves, and cucumber pickles have been revised. Necessary information has been collected for establishing new or revised standards for grades of canned field peas, blackeye peas, white potatoes, maple sirup, canned asparagus, blueberries, okra, spinach, and certain items of frozen produce. Honey, canned plums, pineapple and pineapple juice, apple juice, grapejuice, and carrots are other items on which the necessary basic information is being obtained with a view to revising the grade standards.

Department researchers working in Arizona and California have designed a special pre-cooling tunnel that greatly reduces the time required to cool grapes before starting them on their way to distant markets. Recognizing that the quickest way to improve cooling was to expose the fruit to blasts of cold air, the tunnel is designed to permit such cooling as the unlidded lugs move slowly along to the lidding machine. Air is directed on the open-faced lugs at a velocity of 600 ft. per min.

Commercial coolers of two different types were tested in the specially designed tunnel, one of which had ammonia coils in the bunkers and maintained air blasts of 25 to 30 deg. F. Fans blow the cold air down on the grapes being moved through the tunnel.

The other cooler used ice instead of mechanical refrigeration. Here, the grapes are moved in four layers through the tunnel with propeller-type fans blowing the cold air around the top two layers. A baffle between the second and third layers divides the air stream into discharge and return, and thus prevents the air from by-passing the fruit. Air returning to the bunker cools the lugs on the lower two layers.

Speeds Cooling

With the use of this tunnel, 700 lugs can be cooled in a minimum of 2 hr., as compared with 14 to 18 hr. by other methods, which usually have entailed a full 24-hr. delay in getting a shipment under way. In a season of declining markets, such a delay might mean heavy losses to the shipper and less good fruit on the market.

Under an RMA project at the University of Georgia, engineers have adapted a machine for shelling peas and beans that will satisfactorily handle from 200 to 300 lb. of pods an hour. It is supposed to take an hour for one person to shell 10 lb. by hand.

At Orlando, Fla., more than 1,200 chemicals have been tested in an effort to reduce in-transit losses from stem-end rot of citrus fruit. Four have so far been found effective in cutting losses, but there must be further research to determine the effect of the chemicals on human health before specific recommendations can be made.

Poor Egg Handling

During and since the war, egg shipments by rail have been 10 to 20 percent heavier than prewar. The egg-trade men and shippers say that this heavier loading has been the cause of the tremendously increased damage to shell-egg shipments. Preliminary findings of an RMA study now indicate, however, that most of the damage is caused by lack of proper handling methods in loading the additional cases into the cars. A study along this same line, based on observations of 4,000 cars of peaches packed in baskets, showed that there was no significant difference in damage between loads packed three-layers high, (the usual method) and those packed four-layers high. Obviously, the four-layer load should mean a saving to the carrier, a substantial part of which might well go into reducing the producer-to-consumer price-spread for peaches.

The RMA for the first time authorizes the Department to contract with public or private agencies to carry out research. Under this authority, contracts are in effect with the Railroad Perishable Inspection Agency and the Western Weighing & Inspection Bureau. Called for is collection of detailed loss and damage data on approximately 50,000 carloads of oranges, grapefruit, tomatoes, celery, cauliflower, lettuce, and dressed beef.

This information is being gathered in 86 primary and secondary markets. As soon as possible, it will be tabulated and classified according to the various types of containers used, shipping areas, methods of loading and bracing, and the type of equipment employed in transporting the produce to market.

Transportation rates for agricultural products have, in recent years, increased to a point where they add considerably to the cost of distribution. A study is being made of current freight-rate structures and services with the hope that the information obtained will provide a sound basis for determining whether or not further general freight rate increases are justified.

Study Freight Movement

A related study has to do with increasing efficiency in the use of transportation equipment. With the cooperation of several interested groups, complete records have been obtained on the movement of more than 23,000 carloads of freight. The figures show that nearly 20,000 of these 23,000 carloads were delayed somewhere along the line one day or more, the lags ranging from 1 to 34 days for individual cars.

This and other pertinent information has been presented to the Interstate Commerce Commission and the Association of American Railroads. It is expected that the facts will help to show inefficiences which, if corrected, could alleviate the shortage of transportation equipment and provide better service at reasonable rates.

Equipment Cuts Costs

Mechanized equipment has paid off well in the production of farm crops, but until recently little attention has been given to mechanizing the handling of them in marketing channels. The cost of these operations accounts for a large and increasing part of the total marketing bill for farm commodities. As a basis for recommending cost-reducing improvements, more than 1,300 time-study observations have been made in wholesale stores and warehouses in 36 cities throughout the country.

Results will show how many man-hours are required for unloading and placing in warehouses and stores various kinds of boxes, crates, cartons, etc., with various types of equipment. When findings are sufficiently conclusive, they will be made available to all handlers of farm products, and, there will be an effort to promote wide adoption of handling methods and equipment that will reduce costs.

How to expand markets for certain commodities is the objective of a rather large category of RMA work. Tree nuts was the subject of one such study, the results of which show that producers and processors of this commodity might meet less sales resistance if they would cater more to the needs of confectioners, bakers, and other industrial users of nuts. Some commercial packs, according to the survey, are below acceptable standards of confectioners and ice cream manufacturers. Confectioners say they would use more nuts if it were easier to get the kind they wanted. There is also a need, they say, for nuts that are more uniformly graded and sized. Ice cream makers are wary about buying tree nuts because they sometimes find shell fragments in them, some of the ice cream manufacturers limiting their purchases to nut meats packed in sanitary cartons lined with waxed paper. It is apparent from this survey that nut packers would increase and stabilize their market outlets if they put more stress on quality, size control, sanitation, and good packaging in their sales presentations.

If food processors and distributors are to do a bang-up job of marketing their products, they should have up-to-date information on family food habits, what the trends are, and the influence of income on food purchases. This is clearly evident from the recommendations of the producer-industry committees that have helped plan and set priorities as to what kind of work should be done first under the RMA.

Consumer Survey

A survey covering 1,600 households in 68 large and small cities throughout the country was made in the spring of 1948. Among other things, it shows that American families spent $25.57 a week, or 32 percent of their income, for food, as compared with $14.23, or 26 percent, in the spring of 1942, when a comparable survey was made. The bigger postwar food bills have gone partly into higher prices and partly into larger purchases.

Higher consumption of such things as milk, fruits, certain vegetables, eggs, meat, poultry, and fish indicate that the family's food money in 1948 bought better nutrition than in the early war years.

Family-Group Spending

Here are some other pertinent facts: Families in the $7,500 or more a year group, which had the largest average family size, spent $44.08 a week, or 17 percent of their income, on food; those in the $3,000 to $4,000 group spent $27.06, or 35 percent; and those in the under-$1,000 group, where many were small families, spent $13.76, or 74 percent of their income, for food.

Families in the $7,500 or more bracket used ten times as much frozen fruit and vegetables as those with incomes under $2,000. Purchases of canned fruits and vegetables, soups, and the like, increased as income rose to $4,000, then leveled off or declined.

The examples given here briefly illustrate the wide range of work being done under RMA. Even this short report, however, evidences the serious attention we are giving to specific marketing problems — solutions of which will be of direct benefit to producers, processors and consumers of food products.

COST-CUTTING equipment and other improvements in warehousing form part of another study now being readied for publication.

A SPECIAL FOOD INDUSTRIES REPORT

OPERATION UNDERWAY. This deaeration unit removes entrapped air from tomato catsup. Procedure, seen here adopted in P. J. Ritter plant, Bridgeton, N. J., prevents discoloration and "neck-plug."

THE 'HOW' OF DEAERATION

When air is removed during food processing, much of the flavor, color, and vitamin content is retained—if the operation is done properly. Examined here are the proved methods of today, and assessed are the promising methods of tomorrow

HORACE L. SMITH, JR.

Consulting Engineer, Richmond, Va.

What is the most practical approach for the correct evaluation of the vital role of deaeration in the food industries? The answer to this question depends upon a number of influential factors.

Notably, we must first consider the product itself and its susceptibility to damage from oxidation. For example, entrained oxygen causes unsightly darkening of tomato catsup; it produces off-flavors in fruit and vegetable juices; it disturbs the CO_2 holding power of carbonated beverages, and it also destroys vitamin C and produces oxidized flavors in milk.

It is the purpose of this report to bring the reader up to date on the fundamentals and latest developments in deaeration.

Deaeration Defined

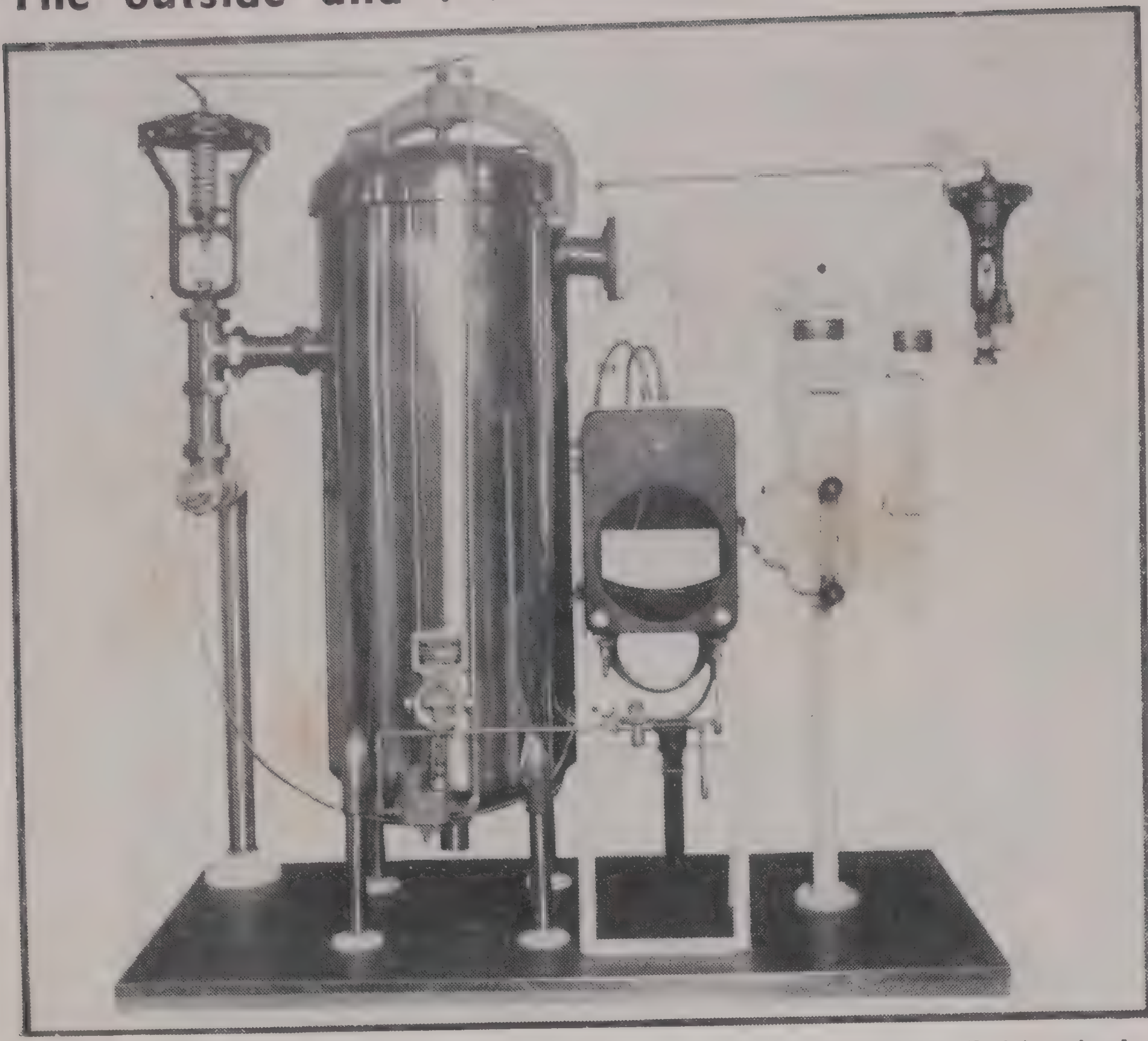
In removing oxygen from food products, especially liquids or semi-liquids, we use the general term, "deaeration." It will be defined as any process that removes air from a product—because, if air is removed, it is obvious that oxygen is likewise eliminated.

Some foods are more susceptible to oxidation than others, but as a general rule it is safe to state that all food products would be better—would suffer less change in taste and flavor—if they were maintained in an oxygen-free condition.

The following specific food products are greatly improved by deaeration: Citrus juices, such as orange, grapefruit, lime and lemon; tomato catsup and tomato juice; apple juice; honey; fresh market milk; strained baby foods; water for carbonated beverages; and vegetable oils.

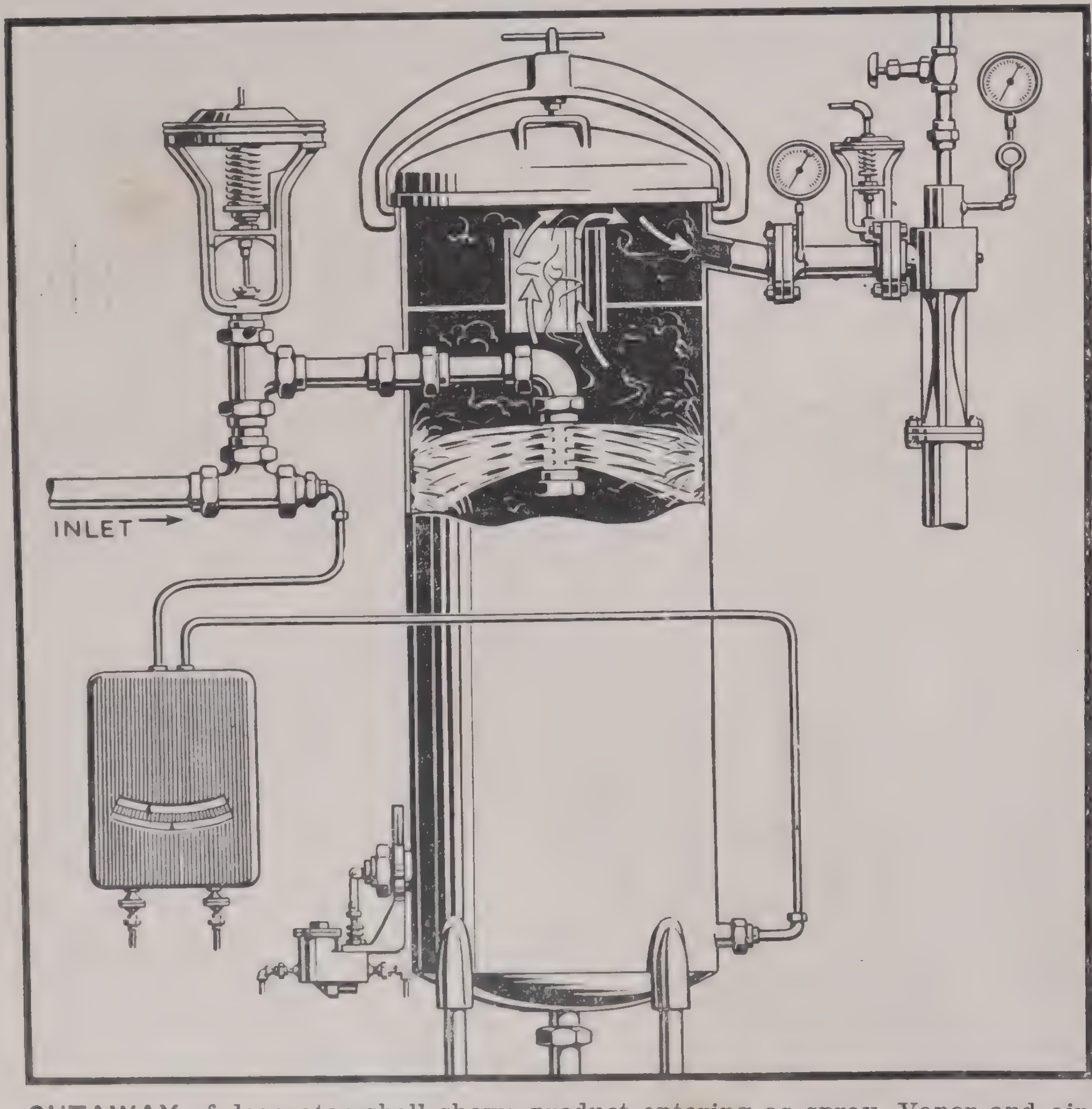
Probably tomato catsup represents the greatest volume of any food product that is deaerated. In its manufacture, standard procedure is to fill at

The outside and . . .



DEAERATOR for tomato catsup, showing product inlet valve (left), single stage steam-jet and condenser (right), vacuum control instrument (center).

. . . the inside



CUTAWAY of deaerator shell shows product entering as spray. Vapor and air rise (arrows) and are sucked to steam jet (right), product falls to bottom and is removed through sanitary line. (Chain Belt photo and drawing)

approximately 190 deg. F. If the bottle is closed by steam displacement, which is now practically standard procedure, a relatively high vacuum is created upon cooling.

Air bubbles that were in the catsup are subjected to this vacuum, and expand to many times their original size, thus creating a very unsightly appearance. Also, this air causes oxidation of the product in the neck of the bottle, producing a hard, dark, almost solid plug, and a definite darkening throughout the contents.

Natural Color Preserved

If properly deaerated just prior to filling, catsup retains the natural bright red color, no air bubbles are apparent throughout the mass, and oxidation in the neck of the bottle is eliminated.

With development of the high temperature pre-sterilization process for tomato juice, it is believed that deaeration before heating to the sterilization temperature will prevent excessive loss of ascorbic acid. Also, it will probably reduce the rate of film build-up on the heat exchanger surfaces. At the moment, however, no data are available to support this theory.

Canned apple juice is becoming a popular food product, and as apple products are very sensitive to oxidative changes, deaeration is definitely beneficial in processing this item. The air content is approximately 80 c.c. per gal. of juice before deaeration. If canned in this condition, the juice lacks apple aroma and flavor and develops a slightly astringent taste. These undesirable results are eliminated by proper deaeration.

An Aid to Carbonation

In the manufacture of carbonated beverages, elimination of dissolved air is desirable. Oxygen causes loss of flavor and aroma in some beverages, while in others oxidation of terpenes in the essential oils, produces an oily and bitter taste.

Because CO_2 is many times as soluble as air at room temperature, (the ratio being approximately 20 to 1), the result is that when a bottle of carbonated beverage is opened, thereby releasing the gas pressure, some of the dissolved air is thrown out of solution, and these minute bubbles or globules of air form nuclei for CO_2 bubbles. It has been estimated that, for each volume of air released from the solution, 7 to 10 volumes of CO_2 are carried out with it. Effect, of course, is that the beverage soon loses its carbonation and becomes flat, whereas if there is no air present, carbonation is retained for much longer periods.

It has been suggested that antioxidant materials be added, but this does not correct all the trouble, in fact is not as satisfactory as deaeration.

Carbon dioxide has what is known as a polymeric characteristic in that, when absorbed by water, it enters into a loose chemical combination, H_2CO_3. In the supersaturated condition, CO_2 is released slowly, causing the prolonged effervescence of some carbonated beverages. Some beverages, depending on conditions, are capable of holding the gas better than others. Certain minerals or colloids, like the proteins in beer, increase their holding-on power, or stability of carbonation, whereas the distribution of fine particles throughout the liquid creates nuclei for the formation of smaller bubbles of CO_2 coming out of solution.

It is generally known that shaking or agitation disturbs the holding power of the liquid, and the CO_2 is liberated much more readily, with violent effervescence or foaming. The agitation need not necessarily be mechanical, since the equivalent of agitation can be caused by small bubbles of air coming out of solution upon decrease of pressure.

Due to the simplicity of the process, its insignificant cost, and the many other benefits derived from it, deaeration of water prior to carbonation should more than compensate for the cost.

Oxidized Flavor In Milk

Fresh market milk is consumed in such prodigious quantities that it is difficult to grasp the significance of the figures. Yet one of the common causes of complaint from the consuming public is oxidized flavor. Milk does not have a pronounced flavor, for which reason the development of any objectionable or off-flavors is readily detected. Work done by Sharp, Hand and Guthrie at Cornell University has proved conclusively that dissolved oxygen is the agent responsible for the development of the oxidized flavor in milk, and is also the cause of the disappearance of vitamin C.

Oxidized flavors do not develop in milk that is oxygen free, and vitamin C is stable in oxygen free milk. Oxidized flavor can be retarded by adding various chemical substances to milk, but these do not necessarily preserve vitamin C. Deaeration prevents development of oxidized flavor, preserves vitamin C, and does not involve the addition of foreign substances to the milk.

Milk has never been accepted as a source of vitamin C of nutritional significance. And yet, of 1,187 samples of fresh milk tested, the average ascorbic acid content was 22.2 mg. per liter, and 65 percent of the samples fell in a range of 18 to 26 mg.

In a test on 1,502 samples of three day old pasteurized market milk, 53.8 percent showed from 0 to 2 mg. ascorbic acid per liter, and the average of all the samples was 2.9 mg. From this it can be seen that the amount of ascorbic acid in bottled fresh market milk, as it is processed today, is of no nutritional significance. But, if the amount of vitamin C originally present could be preserved, milk would be a more valuable source of this vitamin than orange juice. For there is more vitamin C in the milk produced in this country than in the entire citrus crop.

High Quality vs. Off-Flavor

Oxidation of material associated with the fat globules produces off-flavors. In winter time, in pasteurized market milk of high quality, oxidized flavors have been found in as high as 80 percent of the milk tested. Oxidized flavor is more pronounced in milk of high quality, due to the low bacteria count. As the trend in every food industry is toward better sanitation and cleaner operating conditions, the oxidized-flavor defects can be expected to increase.

Dissolved copper is a very active catalyst in accelerating the development of the oxidized flavor, although this flavor will develop in winter milk of high sanitary quality, even in the complete absence of copper contamination, if oxygen is present.

Other Causes

Flavor defects in milk can also be caused by photo-chemical oxidation of ascorbic acid due to the catalytic action of lacto-flavin. Lacto-flavin is the constituent in milk responsible for the sensitivity of ascorbic acid to light. It has been conclusively demonstrated that if oxygen is removed from the milk, lacto-flavin does not act as a catalyst in the development of off-flavors.

Oxygen Present in All Foods

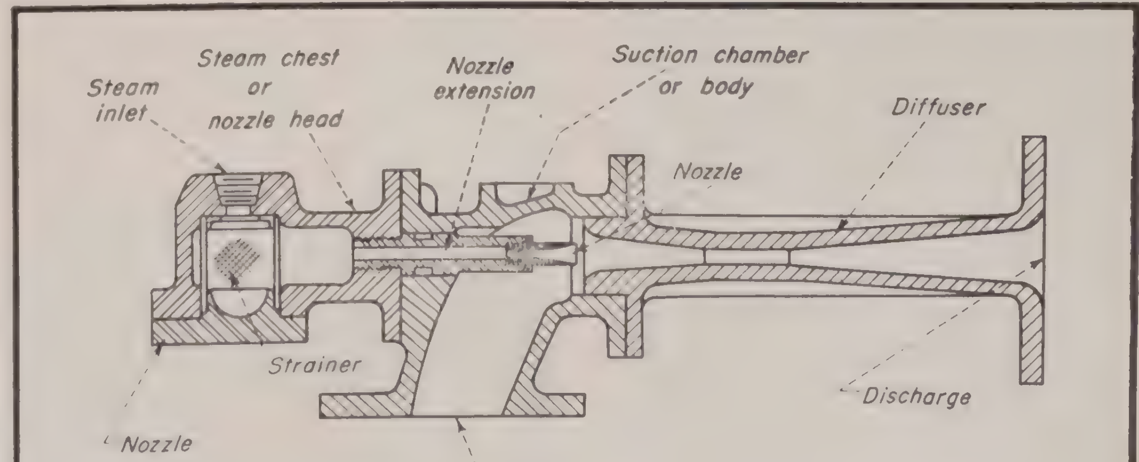
Practically all liquid and semi-liquid food products contain a high percentage of water, and water is a solvent for air. Due to exposure under conditions favorable for absorption of air, practically all food products contain oxygen to some degree. The amount dissolved depends on the product's composition, the amount of exposed surface in contact with air, the temperature of the product, and the length of time it is exposed to conditions favorable for dissolving air. Solubility decreases as temperature increases, and varies directly with the partial pressure of the gas.

It is well understood that gas is diffused from one medium to another, from liquids to vapors or other gases, and from vapors or other gases to liquids, depending upon the concentration and solubility of the gases in question and the different solvents. It is similarly well understood that, in order to cause the movement of a dissolved gas from one medium to the other, it is necessary to produce a partial pressure gradient between them.

Raising the temperature of water to the boiling point corresponding to the existing pressure, reduces the solubility of gases in the water to zero. But, this does not of itself eliminate molecules and bubbles of gas in the mass of the liquid. Unless they are separated, they will enter into solution again as soon as the temperature is reduced and the pressure increased.

In order to escape, the gas molecules must diffuse through the surface film

Working Principles of Gas Evacuator



STEAM-JET EJECTOR for removing condensible and non-condensible gases. High-pressure motive steam enters nozzle-head through strainer, expands through nozzle, and leaves at high velocity. Air, gas, vapor, or a mixture, goes into suction chamber and is entrained by steam. This combination enters venturi-shaped diffuser. Here, velocity-head—reconverted to pressure higher than that in suction area—discharges to atmosphere or into an after-condenser.

surrounding the particle of liquid. Rate of diffusion is proportionate to the concentration of gas within the liquid particle, to the surface area, and to the time of exposure. Diffusion is, therefore, much more rapid from small particles, or very thin films, or a combination of both, than from appreciable masses of still liquid.

There are several practical methods of eliminating dissolved gases from liquids, and to say that one is better than another without specifying the precise conditions would be a misstatement.

Boiling and Stripping

The two simplest and the most practical methods appear to be:

1. Boiling under reduced pressure conditions that expose the product in very finely divided form or in thin films.
2. Stripping by bubbling another gas through the liquid.

In deaerating by boiling under reduced pressure, the apparatus usually consists of a stainless steel shell, or tank, in which the material is sprayed in finely divided form or caused to flow in thin films exposing a large surface area. Vacuum is maintained in the chamber, the degree being such that flash boiling takes place and the temperature of the product is reduced several degrees, usually from 5 to 10 deg. F.

The term, "boiling" does not necessarily denote high temperature, since the temperature at which water boils is a function of the vapor pressure over the water. At sea level, water boils at 212 F. if the vapor pressure is 29.92 in. mercury absolute. For convenience in calculations, barometric pressure is usually accepted as 30 in. Hg. In referring to vapor pressure, especially in the subatmospheric range, it is less confusing to use the term absolute pressure rather than the more generally accepted term, "vacuum."

Barometric pressure is the level of the atmospheric pressure above perfect vacuum. Standard atmospheric pressure is 14.695 psi. or 760 mm. Hg, or 29.92 in. Hg absolute. Gage pressure is measured above atmospheric pressure, while absolute pressure always refers to perfect vacuum as a base. Vacuum, usually expressed in inches or millimeters of Hg, is the depression of pressure below the atmospheric level. An example (referring to a 30-in. barometer) is that we speak of a 20-in. vacuum or 10 in. Hg absolute. A 28-in. vacuum would be 2 in. absolute. In other words, the inches of vacuum subtracted from 30 will give the absolute pressure.

Boiling Point of Water

Although water boils at sea level at 212 F., the boiling point is reduced to 193 F. if the pressure is reduced to 20-in. absolute. If the pressure is reduced to 2-in. absolute, the boiling point drops to 101 F., and at 1-in. absolute, the boiling point is 79 F.

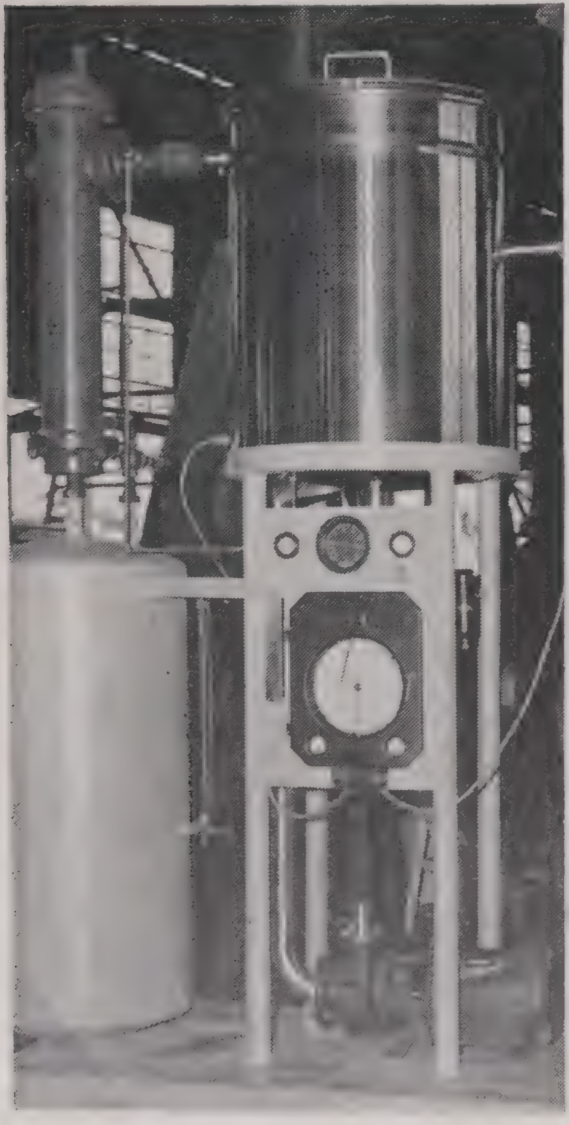
If the pressure is reduced to 0.18 in., which is approximately 29.8 in. vacuum, the boiling point coincides with the freezing point so the water will boil and freeze at the same time. Water cannot exist in the liquid state if the vapor pressure is 0.18 in. Hg absolute or lower, but can only exist in the frozen state, which is ice.

Latent Heat Defined

Although we know that water boils at different temperatures, depending on the vapor pressure over the water, heat must be supplied to the water to cause the boiling. The measure of heat units used in this country is the B.t.u. (British thermal unit). One B.t.u. is the amount of heat required to raise 1 lb. of water 1 deg. F. In order to change 1 lb. of water to 1 lb. of steam at the same temperature, it is necessary to add approximately 1,000 B.t.u. The heat so added is referred to as latent heat of vaporization. In order to condense the 1 lb. of steam, or change its state from a gas to a liquid at the same temperature, it is necessary to extract the latent heat of vaporization —1,000 B.t.u.

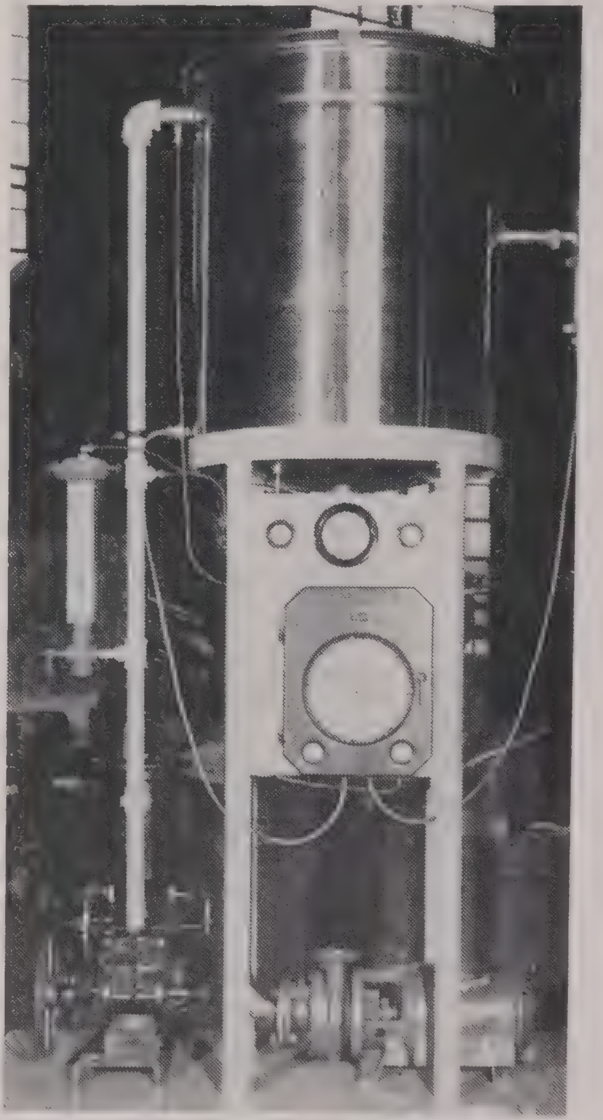
Boiling Under Vacuum

If a vessel is connected with a vacuum-producing device of such capacity that a constant absolute pressure is maintained within the vessel, and a liquid is introduced at a temperature higher than the equilibrium pressure, then part of the liquid will



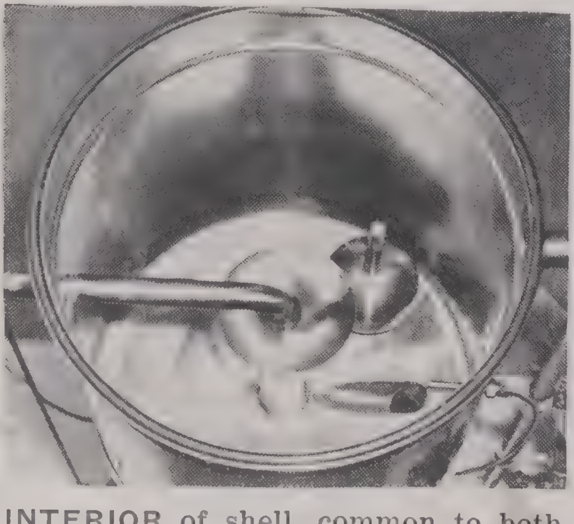
←Uses Steam Jet

Deaerator for citrus juices employs single stage steam-jet ejector for removal of air. Note surface condenser (left).



Uses Vacuum Pump→

This unit is similar to one on left except that a mechanical vacuum pump (lower left) is employed in lieu of steam-jet.



INTERIOR of shell, common to both units, shows deflector which produces thin film to facilitate air removal. (American Machinery Corp. photos) be vaporized or converted into steam and the remainder will be cooled down to the equilibrium temperature corresponding to the vacuum. A simple example will be used to clarify this statement.

Let it be assumed that the vessel is evacuated to 1-in. Hg absolute, which is 29 in. Hg vacuum. The temperature corresponding to this pressure is 79 F. If 100 lb. of water at 89 F. is introduced into the evacuated space, some of it will instantly flash into vapor. The heat required for this evaporation will be taken from the water that remains, so that it will be cooled 10 deg. —to 79 F.—with the release of 1,000 B.t.u. This heat will vaporize 1 lb. of water, causing it to change from a liquid to a gas.

If the water is introduced into the vacuum chamber as a finely divided spray, or in the form of a thin film, part of it flashes into vapor. As this vapor is generated throughout the mass of the liquid, a stripping action takes place—bubbles wash out and carry with them the dissolved and entrained air and other non-condensible gases that were present.

This has proved to be a practical, simple, and reliable method of deaerating liquid and semi-liquid food products.

In order to secure reasonably complete deaeration, it is usual to flash the product from 5 to 10 deg. F. In other words, the product will flash down to a temperature corresponding to the vacuum being maintained, so if the vacuum is adjusted or regulated to bear a constant relationship to the temperature of the product entering the deaerator, the product will always flash through a definite range.

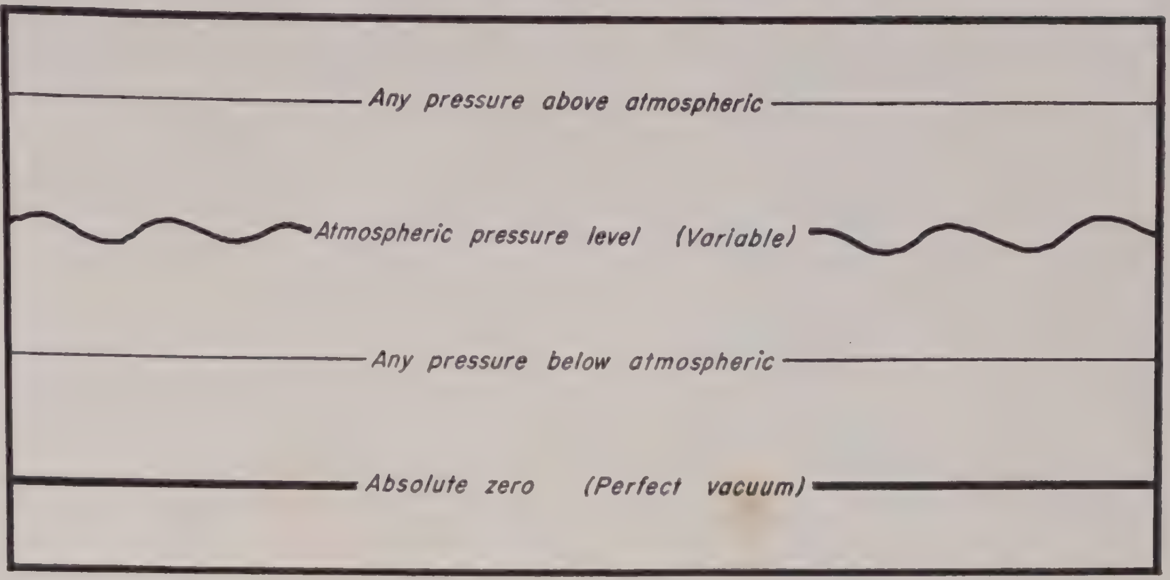
Many Foods Heat-Sensitive

Deaeration could be secured by raising the temperature of the product to its boiling point at atmospheric pressure—approximately 212 F. But, since many food products are heat sensitive, product damage would occur. To prevent this, the deaeration of food products, by causing generation of water vapor from the product itself, is usually carried out at subatmospheric pressure.

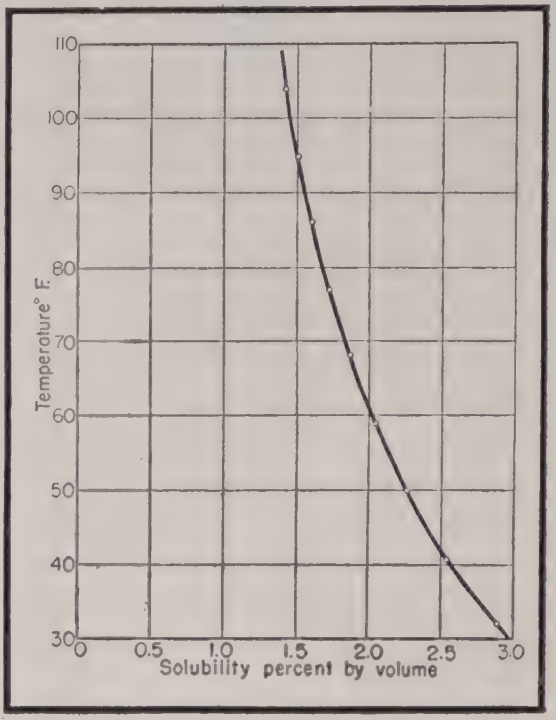
In order to maintain a constant vacuum in the deaerating chamber, some means must be provided not only to produce the initial vacuum, but to remove the water vapor at the same rate at which it is being liberated.

Boyle's law can be expressed in the form, "The volume of a gas varies inversely as its absolute pressure." This means that, as we increase the vacuum or decrease the pressure, the volume that 1 lb. of water-vapor occupies will increase. At atmospheric pressure, 1 lb. of water vapor occupies approximately 26 cu. ft. and boiling occurs at 212 F. If the pressure is reduced to 1 in. absolute, which corresponds to a boiling temperature of 101 F., then 1 lb. of water vapor occupies approximately 350 cu. ft., and if boiling occurs at the freezing point, 1 lb. of water-vapor occupies 3,300 cu. ft.

Pressure Chart and Air Solubility Curve


Any pressure above atmospheric
Atmospheric pressure level (Variable)
Any pressure below atmospheric
Absolute zero (Perfect vacuum)

BAROMETRIC PRESSURE is the level of atmospheric pressure above perfect vacuum. "Standard" atmospheric pressure is 14.695 psi., or 760 mm. Hg. The gage pressure is measured above atmospheric pressure, while the absolute pressure always refers to perfect vacuum as a base. Vacuum, usually expressed as in. Hg, is depression of pressure below atmospheric level.



SOLUBILITY of air in water, or → in liquid or semi-liquid foods containing a high percentage of water, decreases as temperature increases.

Vacuum-Producing Units

Due to the relatively large volume of water-vapor that must be continuously removed from a deaerator, the vacuum-producing device must operate efficiently when handling large volumes of gas at high vacuum. There are many types of vacuum pumps, including the reciprocating piston type, dry rotary pumps of several forms, water jet ejectors, and steam jet pumps. For most applications, steam-jet equipment appears to have many advantages over the other devices.

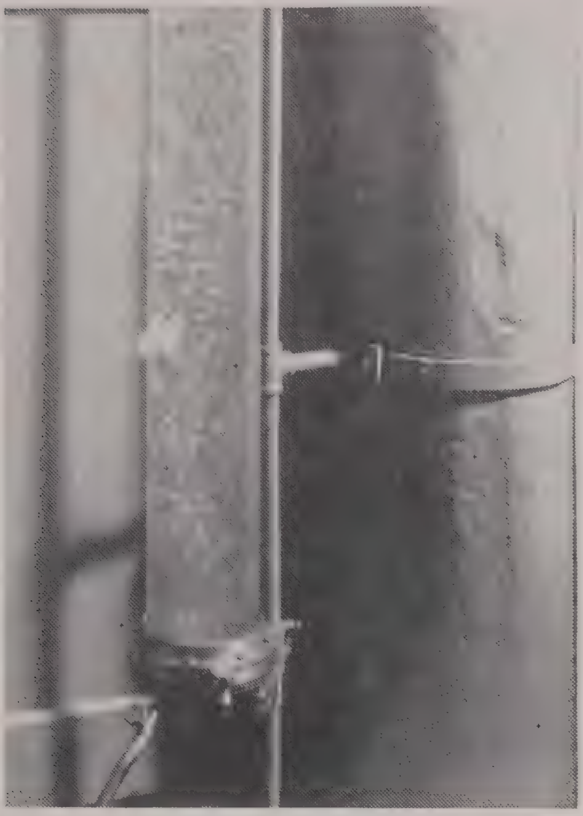
A steam-jet vacuum pump is essentially a kinetic energy device in which steam is expanded through a cone-shaped nozzle, under the conditions that produce very high velocity as the steam leaves the nozzle. This high velocity cylinder of steam entrains surrounding gases, and the mixture enters a venturi-shaped diffuser, where the velocity head is reconverted into pressure higher than that at the suction, but materially less than that of the motive steam.

For relatively low vacuums—that is down to 4-in. absolute or 26-in. vacuum—single-stage steam ejectors, discharging to atmosphere, can be used. For lower pressures, it is necessary to resort to two or more stages. In other words, there is a limit to the pressure range of the steam jets, and for higher vacuums it is necessary to use more than one stage. Two-stage units will operate within the range 0.4 to 4 in. Hg, and if it is desirable to operate at pressures less than 0.4 in. Hg, three stages are required.

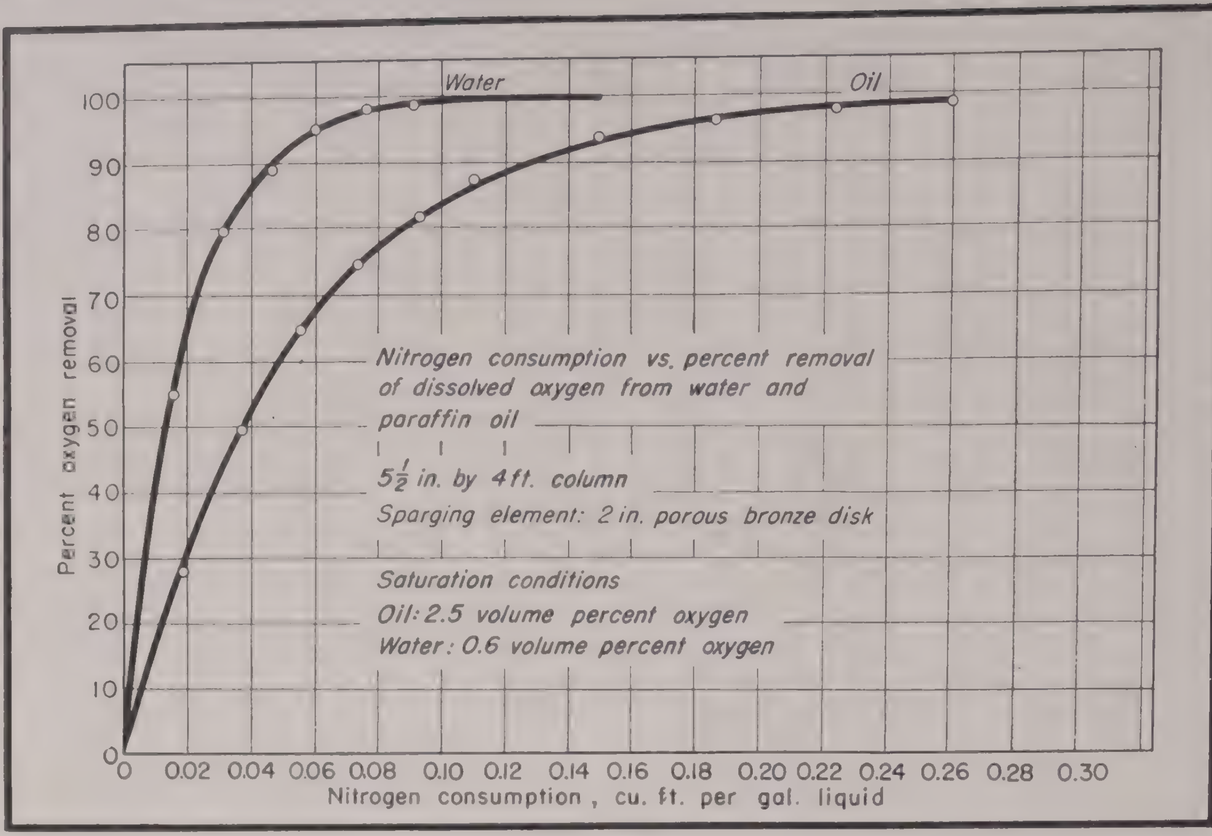
Steam Jets In Multiple Units

There are a number of combinations of multi-stage ejectors that can be used, and the proper selection depends upon the circumstances of the case. The simplest arrangement is where one ejector discharges directly into the suction of a second, without the use of an inter-condenser. This arrangement is lowest in first cost, but the operating cost is high, because the second stage must have capacity for removing not only the non-condensible gases but

New Gas-Replacement Method Shows Promise



EXPERIMENTAL UNIT, 5½ in. dia. x 4 ft. high, demonstrated efficiency of oxygen removal from water by stripping with nitrogen.



DEAERATION by stripping with nitrogen is, in effect, a gas-replacement process. Accordingly, its economy is governed by nitrogen consumed. Chart (above) shows nitrogen consumed in removal of oxygen from water, and from oil, in experimental column (left). (Linde Air Products Co. photo and chart.)

also the motive steam from the first stage. Usually, an inter-condenser is placed between the two jets so that the steam from the first stage is condensed. Capacity of the second stage is then determined by the amount of non-condensible gases to be removed.

When three stage units are required, it is customary to use an inter-condenser between each two stages. Therefore, the unit would consist of three steam ejectors and two condensers, the last ejector discharging direct to the atmosphere. If discharge of steam to atmosphere is objectionable, an after-condenser may be used to eliminate the nuisance.

Vacuum-Regulating Device

A simple and effective method of regulating the vacuum is to use a control instrument that can be adjusted to maintain a constant difference between temperature of incoming and outgoing product. For example, this instrument may be set to maintain a differential of 8 deg. Then, it adjusts the vacuum so that the exit temperature of the product is always 8 deg. lower than the inlet temperature.

The vacuum adjustment can be a device to throttle the connection between the deaerator shell and the vacuum pump, or air can be admitted to the vacuum pump to partially overload it, thereby reducing the vacuum in the deaerator. These temperature-vacuum-regulating devices are reliable and accurate.

It is surprising to note that, where investigations have been made on deaeration of food products, little importance has been attached to the correlation of vacuum to temperature of product. Some deaeration will occur under reduced pressure, but unless the pressure is reduced to a point whereby actual boiling and auto-refrigeration takes place, it is almost impossible to secure complete deaeration. Even boiling is not sufficient, since the product should be exposed in very thin films or small droplets.

Because steam jet ejectors are used more extensively than any other vacuum producing device, some of the maintenance and operating problems will be discussed. Steam jets are designed to operate at the available pressure, and they work most efficiently at this pressure. Reducing the pressure below this value causes the jet to "break", and then steam flows into the vacuum chamber.

Constant Steam Pressure

In other words, if the steam pressure at the nozzle is reduced, the high velocity column of steam does not have sufficient kinetic energy to overcome the higher pressure beyond the venturi-throat, and a reverse flow takes place, completely destroying the vacuum. On the other hand, if steam pressures are used that are higher than the designed pressure, the volume capacity of the ejector is reduced because the diffuser throat is filled with more steam. Therefore, there is less available area for the gases being evacuated.

Unless steam pressure is absolutely constant and reliable, best practice is to have ejectors designed for a pressure lower than the lowest boiler pressure anticipated and to provide a reducing valve ahead of the ejectors so that they will operate at a constant pressure regardless of fluctuations in line pressure.

The high pressure steam increases in velocity at a tremendous rate as it passes through the nozzle. Being a gas with relatively low density, steam can accelerate rapidly. Entrained droplets of moisture cannot accelerate at the same rate as the steam. Therefore, they tend to reduce the average velocity of the steam and cause the jet to break, similar to conditions at sub-normal steam pressure.

Dry Steam Improves Operation

It is essential that steam jets be provided with dry steam. Hence, well-designed separators should be installed ahead of the jets, and if a pressure reducing valve is used, the separators should be on the up-stream side of it. Separators should be well trapped so as to continuously remove the moisture from the steam. Steam lines should be properly insulated to reduce condensation.

One of the most important details in piping up a steam-jet vacuum ejector is that, if the steam supply is taken from the main header or distribution main, the "T" should always look up, so that any condensation carried along the bottom of the main steam pipe will not be diverted to the branch supplying the steam jet.

When inter-condensers are used,

they can be of the shell and tube type (whereby the condenser water does not come in contact with steam), or the more usual jet or barometric type (in which the condenser water comes in direct contact with the steam).

Two Types of Inter-Condensers

Jet condensers are always cheaper, and they are more efficient because closer terminal differences can be maintained. Since they practically always operate under vacuum, it is necessary to install them at an elevation sufficient for drainage by a barometric leg. If this is not feasible, a pump must be used to remove the water from the condenser at the vacuum existing in same.

A barometric leg is always preferable because there is no operating expense, no moving parts, and, therefore, nothing to cause trouble. If used, it should be of sufficient size to provide low velocity for the condenser discharge, and it should extend in a vertical straight line from the bottom of the condenser to a seal tank at the foot of the pipe.

If horizontal offsets have to be made in the tail-pipe, they should be at 45 deg.—never less than 30 deg.—and preferably close to the seal tank rather than close to the condenser. The barometric leg should be checked and rechecked for tightness, because even a very small air leak in a fitting or screw connection can then cause no end of trouble.

If a pump is used with a jet condenser, the tail pipe should extend straight down to the suction connection of the pump. Even though a pump is used, the condenser should be mounted as high above the suction connection as possible in order to secure the maximum submergence head. A horizontal connection should never be made between pump and tail pipe, and if it is necessary to offset the pump, a 30 to 45 deg. offset should be used.

Three-Stage Jet Unit

If vacuum conditions require a three-stage steam jet unit having two inter-condensers, the condensers will operate at different pressures. The first will obviously be at a higher vacuum than the second. Therefore, the two condensers should be provided with separate barometric legs or tail-pipes, or with separate pumps, if pumps are required.

It is possible to connect the two tail-pipes together if a loop seal is provided in the leg operating at the higher pressure.

In other words, the second, or high pressure condenser leg, should extend down vertically; then, by means of a return bend of 180 deg., the pipe should come back upward at least 8 ft., and thence go horizontally into the leg of the high vacuum condenser.

Condensers should be fitted with sight glasses to indicate if flooding occurs, and the water supply to each condenser should be adjusted according to design conditions of quantity and temperature rise. If condenser removal pumps are used, care should be exercised to see that the sealing gland is maintained in first class condition, because the slightest air leak at this point will cause failure of the equipment. Use of a water-sealed lantern gland is always good practice with pumps that operate under vacuum on the suction side.

Removal of Deaerated Products

The above remarks apply also to removal of the product from the deaerator chamber. The deaerator is always under a higher vacuum than the condensers, therefore the product must be taken from the existing vacuum. The same principles as to barometric leg or removal pumps apply as mentioned for the condensers, with the additional provision that all metal surfaces coming in contact with the product are usually required to be stainless steel, or some equally acceptable material.

There are some products that make it impossible to use a water-sealed gland, due to the chances of contamination or pollution. Under these circumstances, the utmost care should be exercised to keep the packing gland in A-1 condition.

Large Units Need Extra Condenser

For very large deaerator capacities, it is sometimes desirable to use a condenser between the deaerator chamber and the first stage steam-jet evacuator. This permits condensing the water-vapor flashed in the deaerator shell so that the ejector load for all of the stages is limited to the non-condensible gases removed from the deaerator. Where this type of installation is used, the first condenser operates at the same vacuum as the deaerator shell.

In addition to deaerating by vacuum boiling, a very interesting and promising development of recent origin is the method of bubbling nitrogen, or some other inert gas, through the product to be deaerated. The Linde Air Products Co. (a unit of Union Carbide & Carbon Corp.) has carried out extensive research on deaeration by stripping with nitrogen. With this method, one definite advantage over vacuum boiling is that, where products contain volatile constituents, vacuum boiling removes them, whereas nitrogen stripping does not.

In the deaeration of a product such as single strength orange juice, it would appear that nitrogen stripping possesses many advantages over vacuum boiling. The same principle would apply, of course, to many other products. On the other hand, there may be occasions where it is desirable to eliminate volatile products, and here vacuum boiling would possess advantages over the nitrogen method.

Experimental work carried out by Linde indicates that, when using a stripping column of 5½ in. dia. by 4 ft. high (see photo), 99 percent of the dissolved oxygen can be removed from water with the use of .09 cu. ft. of nitrogen per gal. Efficiency of oxygen removal per unit volume of gas consumed is proportional to the effective contact area of gas-liquid interface. This would indicate the desirability of dividing the stripping gas into very small bubble sizes, using a sparging element that produces uniform distribution throughout the cross section of the tower, with a counter-flow operation.

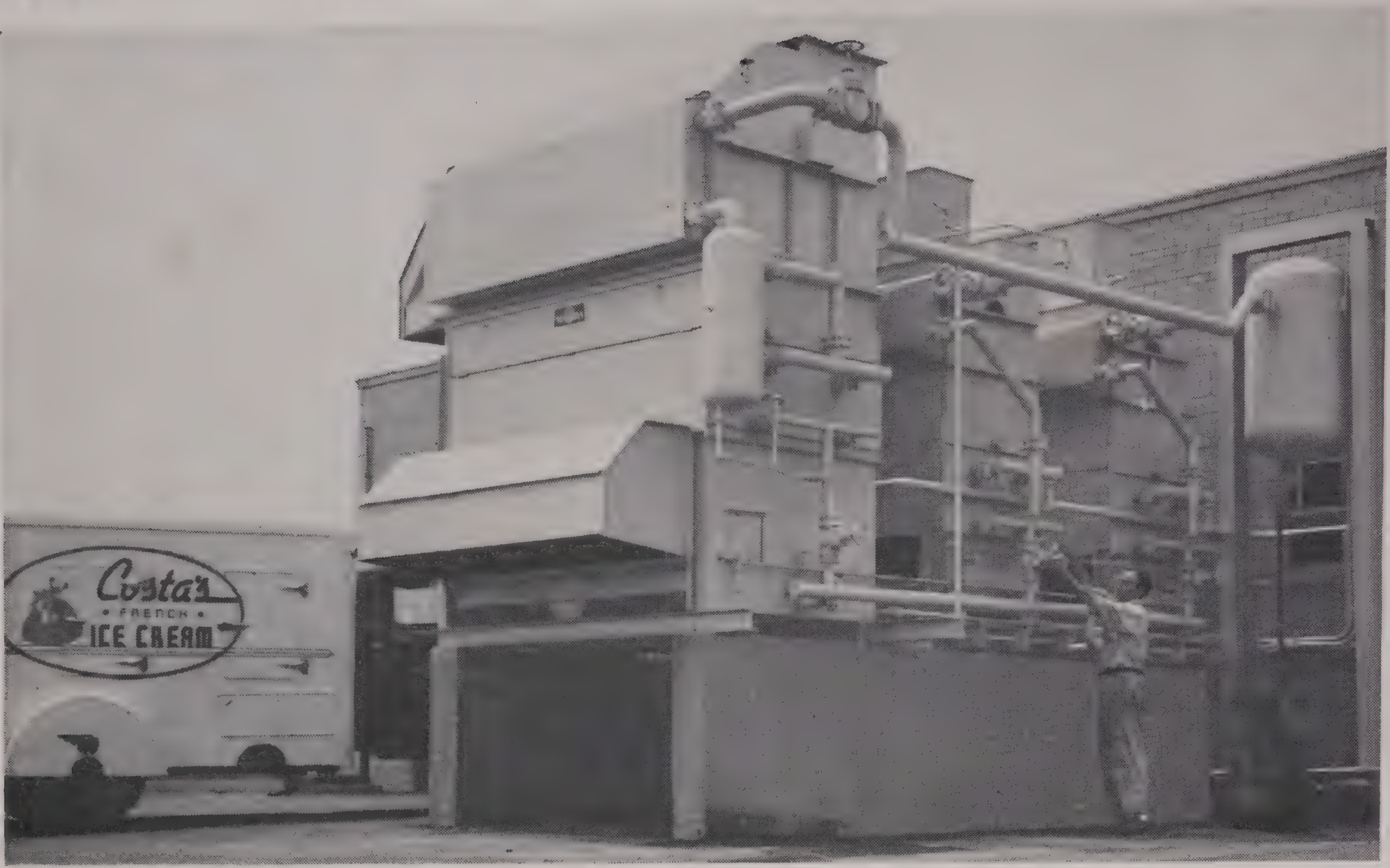
Recent Developments

Deaeration by stripping with nitrogen is, in effect, a gas-replacement process. Accordingly, this method would not be satisfactory for products like tomato catsup, because, although oxygen would be removed, the product would be saturated with nitrogen, and probably a large amount of the nitrogen would be retained in the occluded form. This nitrogen would be almost as objectionable in the finished product as the air that it replaced.

In treating any product where it is desirable to remove all non-condensible gases in order to eliminate foaming conditions, the vacuum boiling method is definitely superior to nitrogen stripping.

It is difficult to make cost comparisons of vacuum boiling versus nitrogen stripping because no data is available as to the commercial operation of the inert gas method.

An interesting development that should further interest in nitrogen-stripping has resulted from research of Baker & Co., Inc., a subsidiary of Engelhard Industries. It is a process for the generation of nitrogen by the direct interaction of anhydrous ammonia with air in the presence of an Engelhard catalyst. The unit is known as the "Nitroneal Generator." Apparently, the great advantage of this method is the low cost. Approximate cost of nitrogen gas in cylinders is $14.00 per 1,000 cu. ft. When using ammonia from cylinders, the Nitroneal gas costs about $2.30 per 1,000 cu. ft. The reaction is exothermal, hence the only cost of operation is approximately 100w. for starting and current required for operating the electrical instruments. It is claimed that the gas is completely free of oxygen.



THESE evaporative condensers reduced cooling-water requirements by 76 percent, although plant capacity was increased. Operating head pressure was also diminished, resulting in lowered power consumption per ton of refrigeration.

Cooling Performance With a Capital "P"

... came quick when this ice cream maker put in new water-and-power-thrifty equipment, plus automatic defrost. Now plant output is highest ever

IVAN C. MILLER
Editorial Consultant, "Food Industries"

Higher Productivity
Lower Costs

It was advanced engineering that set the stage for the notable increase in production recently attained at the Costa Ice Cream Co. plant in Woodbridge, N. J. And most prominent in this engineering was the attainment of a striking economy in cost per ton of refrigeration.

Comparison with figures on the company's previous operations in Metuchen, N. J., demonstrated the progress.

In the new engineering, the following problems pertaining to refrigeration were considered:

1. How to reduce cooling water requirement and at the same time lower the head pressure on refrigeration compressors.
2. How to increase compressor capacities.
3. How to maintain uniform subzero temperatures in the ice cream hardening rooms in spite of the warm air infiltration due to opening and closing of doors.
4. How to eliminate the losses in operating time and labor usually associated with defrosting of the cooling system.

Cooling Water a Problem

One of the major items plaguing the old plant was the large amount of cooling water needed for the shell-and-tube type ammonia condensers. In the new plant, Niagara evaporative-type condensers are installed. And now, in spite of an increased refrigeration compressor capacity, the cooling water requirement is 76 percent less.

Upon leaving the compressors, the hot ammonia gas is first cooled in a unit condenser consisting of wet-bulb controlled coils cooled by an air blast. Then, the gas passes through an oil separator and dirt filter before entering the evaporative condensers. Here, cold water is sprayed on the outside of the condensing coils as air is sucked up around them—entering at the bottom of the unit and discharging from the top. Air circulation is produced by blowers mounted on the top of the units. Ammonia in the coils is condensed by evaporation of water on the outside.

Because the ammonia gas is precooled before it reaches the evaporative condensers, the cooling water never gets to the boiling point. Therefore, no scale forms on the coils to diminish the efficiency of cooling. The only water loss in this system is from evaporation.

The system has proved so efficient that it has reduced the load on the compressors, enabling them to meet increased capacity requirements. And at the same time, it has reduced power consumption per ton of refrigeration.

When the shell-and-tube type condensers were used, hot gas pressure often reached 200 psi. in summer. Now, the pressure during most of the year is between 125 and 150 psi., and as low as 100 psi. in the winter. This has resulted in lower power consumption per ton of refrigeration, and maintenance savings should also be apparent, as well as increased life of the equipment.

Sub-Zero Storage Rooms

The two hardening rooms in the plant, which are kept at −20 deg. F., except during working hours, have a combined capacity of 55,000 cu. ft. During working hours, warm air from the outside has access to the hardening rooms through eight openings—three loading doors, through which 13 trucks are supplied; two walk-in entrances, from processing rooms; and three loading entrances, through which conveyors pass from the processing rooms. Maintaining a sub-zero temperature when there is a constant influx of warm air, presents a real problem in any plant, and usually necessitates frequent defrosting of the cooling units or coils.

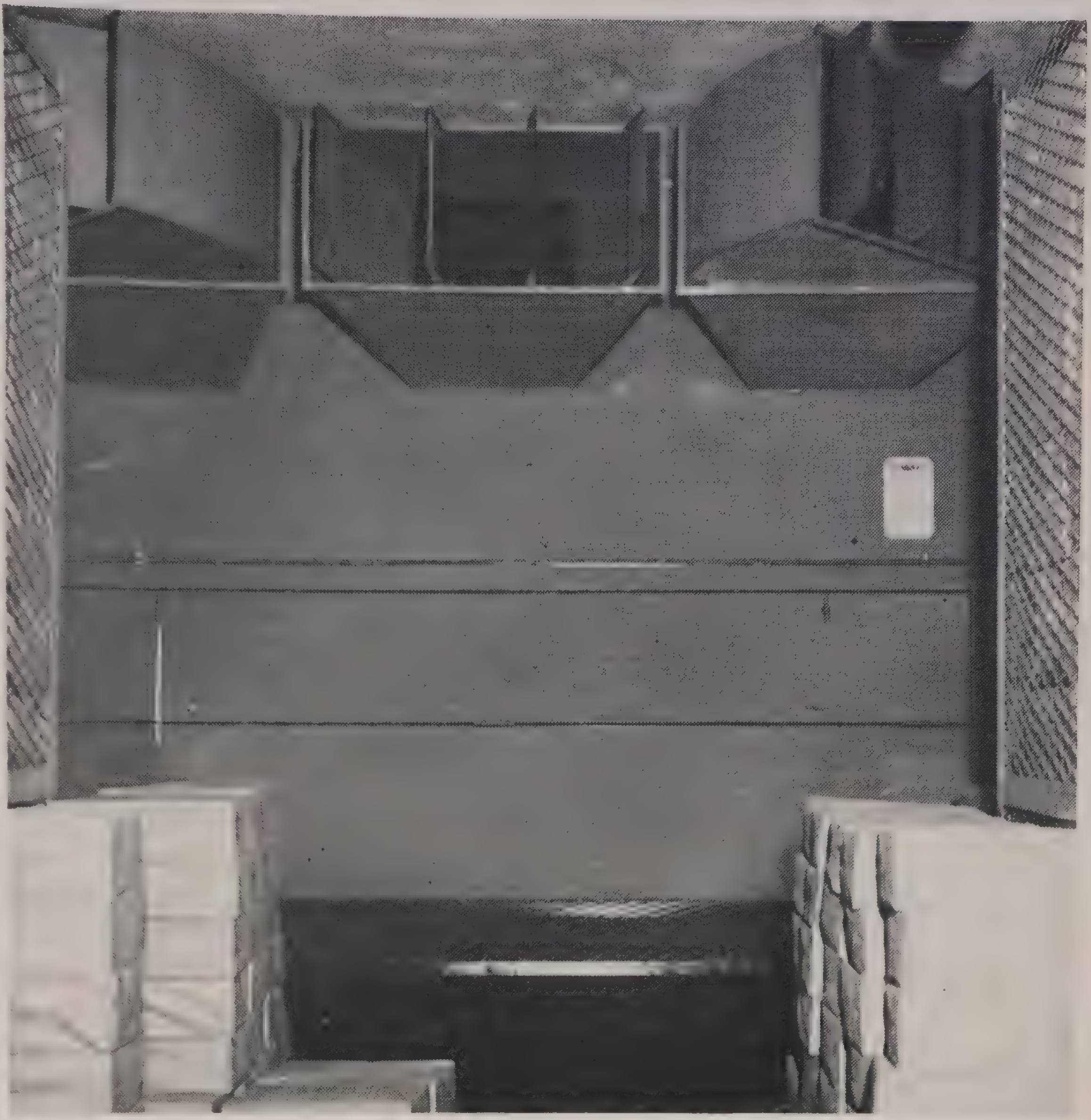
A material saving has been effected through the use of three air blast-type unit coolers, the coils of which are continuously sprayed with a chemical to prevent formation of frost. Full efficiency from the evaporation of the ammonia is thereby obtained with no impairment to quality of product through temperature rise—as would be the case were frequent defrosting necessary. Temperature changes in the hardening rooms are now kept within a safe range, even during the hottest months when production volume is at a maximum.

The chemical condenses the moisture which would otherwise form frost on the coils of the unit coolers. Granted, this moisture dilutes the solution. However, the problem thus arising of the solution freezing on the coils has been obviated by the installation of a continuous concentrator. Liquid flows from the coolers to this concentrator, where controlled distillation evaporates the accumulated moisture, and returns the liquid to the correct chemical composition for re-use in the system.

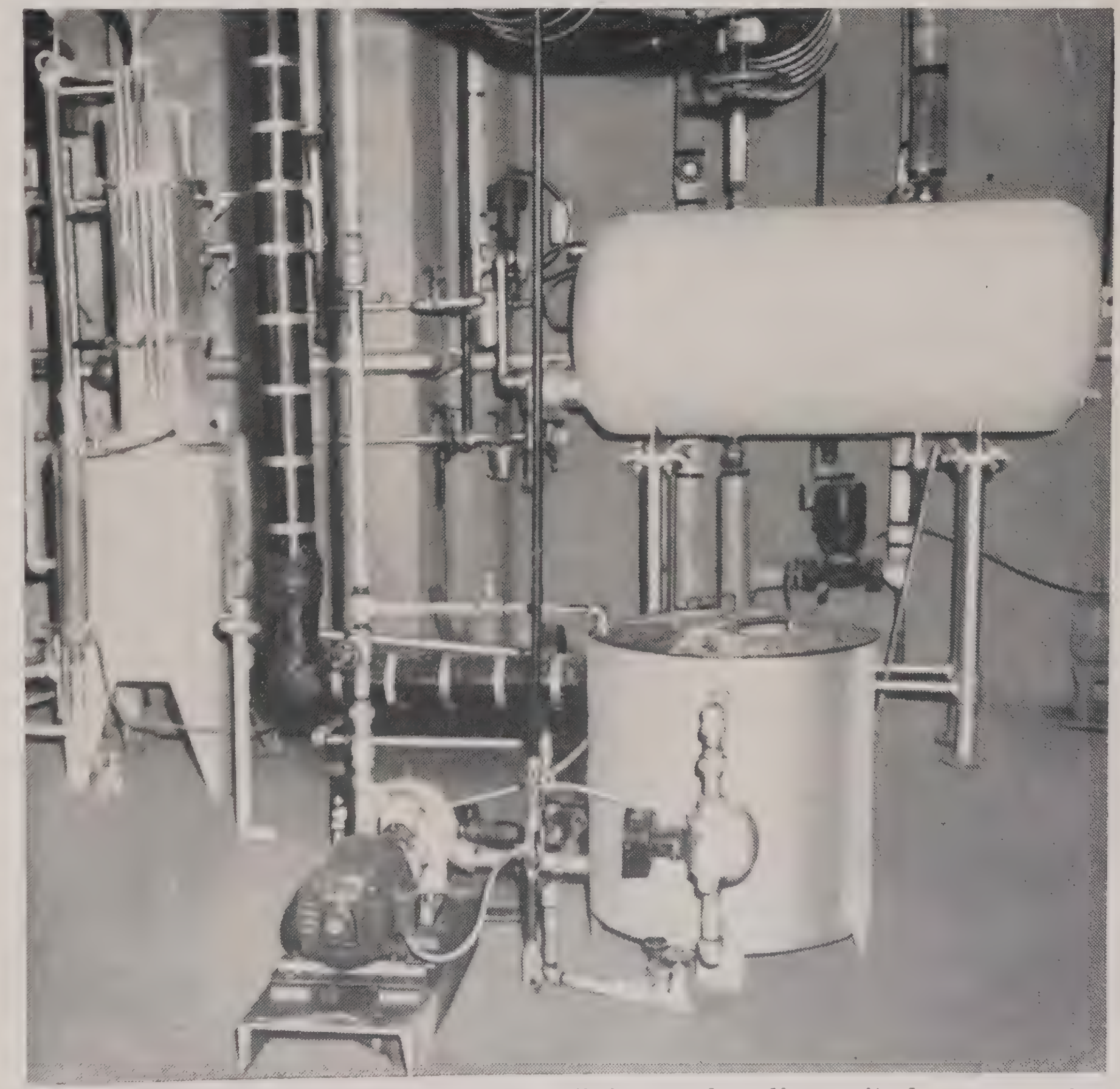
Continuous Defrosting Saves Labor

This cooling system has operated without interruption during the last two years, maintaining desired temperatures. And there has been no manual defrosting, with its attendant expense of added labor, lost operation time, and product quality impairment. And even though the hardening room refrigeration has recently been increased with the addition of another unit cooler, the original concentrator has maintained solution strength and automatic defrosting efficiency.

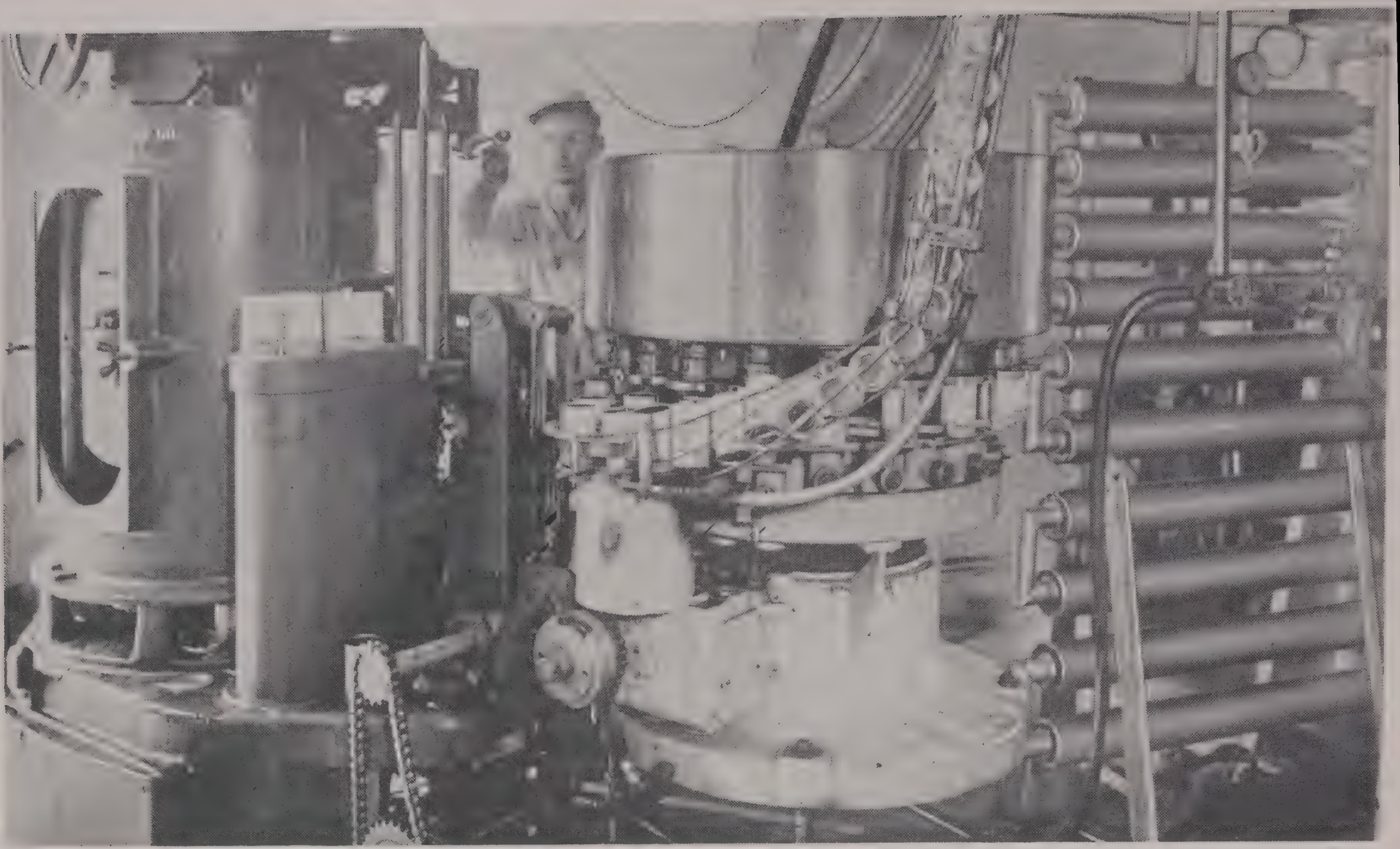
SAVED: Defrost Labor



ONE of the coolers. Three such units maintain hardening room temperatures at 20 degrees below zero, yet require no manual defrosting.



THIS continuous concentrator assures efficiency of cooling units by evaporating accumulated moisture from defrosting solution.



FINISHED VAL-SWEET comes off the canning line. Company also bottles it. Note the heat exchanger (right).

11 Grape Varieties Blended in New Drink

Using California table and wine types, high percentage of fruit constituents is retained in the beverage. Aim is to process 2,500,000 gal. this season

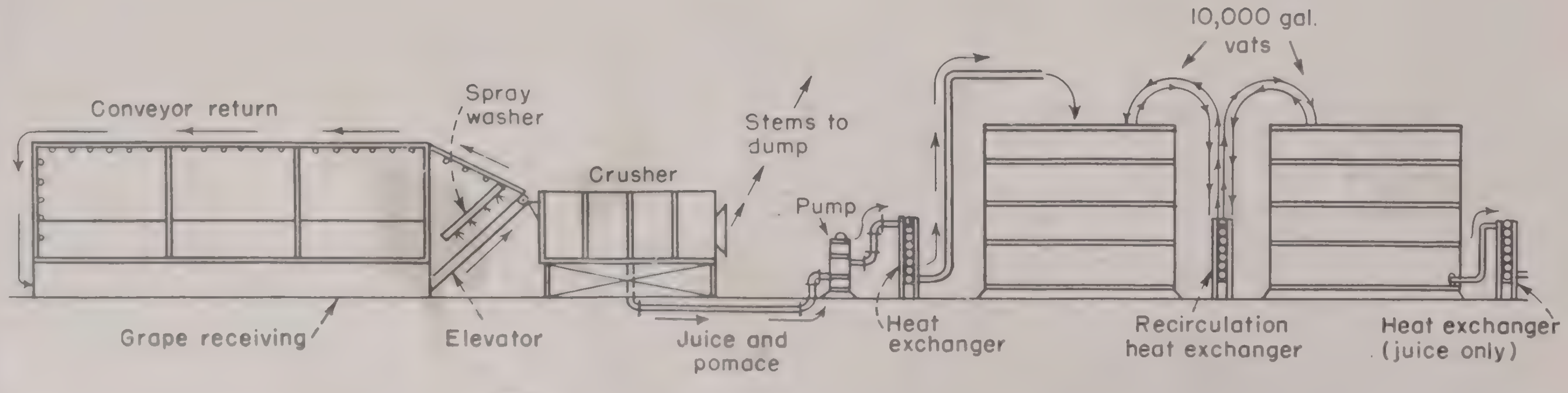
A. SCHAPIRO
Vice-President, California Grape Colony,
Lodi, Calif.

Juices from eleven varieties of grapes are blended in the new beverage, "Val-sweet", produced by California Grape Colony. Five of the grape varieties are the kind shipped from San Joaquin Valley as "table" grapes for consumption as fresh fruit. The other six are of the type used in wine making. This mix proved "right."

It is reported that the finished blend represents 98 percent of the 140-deg. water-soluble constituents of the original fruit.

The company, which was formerly

GRAPE BEVERAGE LINE OF CALIFORNIA GRAPE COLONY


10,000 gal. vats
Conveyor return
Spray washer
Stems to dump
Crusher
Pump
Grape receiving
Elevator
Juice and pomace
Heat exchanger
Recirculation heat exchanger
Heat exchanger (juice only)

located in Fresno, recently moved operations to a large, modern winery at Lodi, Calif. This plant is leased from Italian Swiss Colony. Plans call for the crushing of 12,000 tons of grapes this season—which will make about 2,500,000 gal. of the beverage.

At maturity, the grapes employed have a juice low in acid and high in sugar content. For this reason they are unsuitable for ordinary beverage juice purposes. In short, they are unlike the Concord variety, which is comparatively low in sugar, high in acid.

During the vintage, 100 to 125 tons of grapes are received and crushed daily. The crusher is a large, enclosed, perforated cylinder with revolving paddles arranged on a central shaft in helical order. The clusters of grapes drop into the cylinder and the revolving paddles crush the fruit. The juice and pomace drop through the perforations and are pumped through a heat exchanger to receiving tanks. The stems are ejected from the end of the machine.

The grape juice, skins and seeds are next pumped to tanks. The juice of the black varieties and the juice of white grapes are kept in separate tanks. Extractions of the white grapes are later passed through the pomace of the black varieties in order to recover the residual color. And finally all extractions are blended.

Second step in extracting juice from these grapes is to separate the free-run juice from the pomace. This juice and pomace mixture is pumped from the tanks to a heat exchanger and heated to 140-160 deg. F. to cause the cellular structure of the fruit to release more free-run juice. And, in the case of all varieties, this heating also extracts more body and color from the skins. The material is routed from this heat exchanger to redwood extraction tanks (10,000 gal. capacity) where, within a few hours, the skins and seeds rise to the top and the free-run juice is then drawn off at the bottom and pumped to a holding tank.

Free-run juice is so called because it is that derived from the crushing operation. It varies from 22 to 28 percent soluble solids, depending on the varieties of grapes crushed.

Remaining Sugars Leached Out

Since California grapes run high in soluble solids, the pomace remaining in the tank still retains substantial grape sugars that can be extracted by leaching.

At the outset of the season, the first water extraction was, of necessity, done with clear water at 140 deg. F. A quantity of water identical to the amount of the free-run juice (which was drawn off the pomace), was added to the remaining material. During this process the temperature of the material and water is carefully controlled at the 140 deg. F. by recirculating the mixture to a second heat exchanger and then back to the tank.

Within a few hours, the pomace again rises to the top of the dilute juice extracted from the skins. This juice, which tests approximately 16 degrees Balling, is then pumped to a separate tank. Subsequent leachings, five in number, each provide a diminishing amount of soluble solids. The first, as mentioned above, tests about 16 degrees Balling, and the fifth at approximately 2 degrees Balling.

The 2 degree juice is then used for subsequent leaching of richer pomace tanks, until it is built up to 16 to 18 percent soluble solids determined by the Balling hydrometer. This juice is then used to dilute the free-run juices to 20 degrees Balling. It is drawn into the vacuum pan as needed. Clear hot water is used only in the fifth and last pomace leaching.

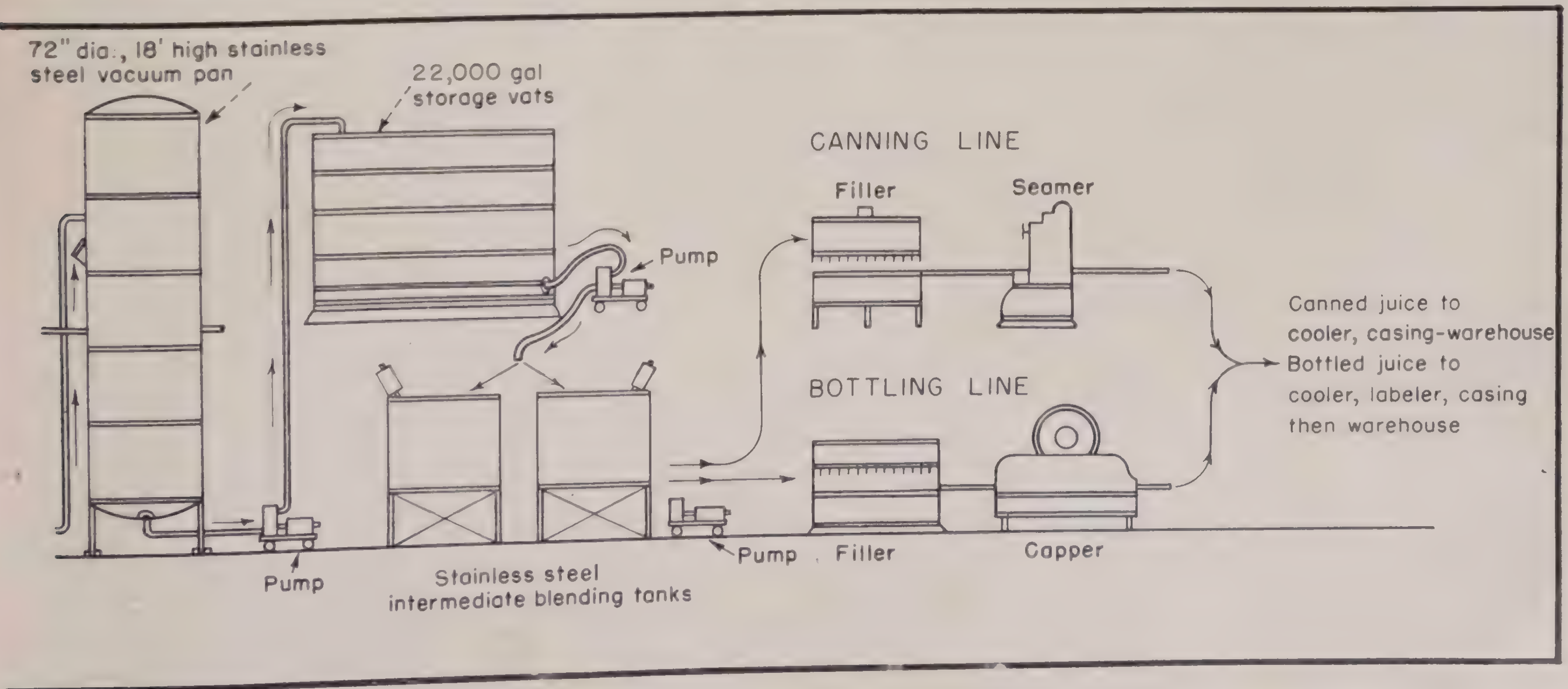
Certain leachings are maintained between 100 and 120 deg. F. to permit the development of higher acidity and distinctive flavors by selecting microorganisms of the acid producing type, normally used in food industries. Later, this juice is carefully blended with the juices fed to the vacuum pan. Resulting concentrated juices at 70 deg. Balling are then removed to storage. The acidity and concentration permit keeping at normal temperatures.

Pasteurized Before Concentrating

The juice is drawn from storage tanks and flash pasteurized before entering the vacuum pan. This pasteurization, prior to concentration, reduces the thermophilic bacteria that may have survived the leaching temperatures. Temperature in the vacuum pan is held at 110 to 115 deg. F. Steam mixed with condensate water at 3 psi. maintains this temperature in the heating coils with no danger of burning the product. With an input of 25,000 gal. of juice per 24-hr. day, this vacuum pan delivers 5,000 gal. of concentrated juice at 70 deg. Balling.

The pasteurized concentrated juice is then pumped to storage tanks, where it is held until needed for blending and then canning or bottling. It is stated that this juice represents a nutrient value such as obtained in eating grapes while eliminating skin and seeds.

From the storage tanks, the concentrated juice is pumped to stainless steel blending tanks located in the canning and bottling room. The final product is standardized at 17 Balling, which is slightly higher than straight Eastern juices with no sugar added. Tartaric acid, U. S. certified food color, and specially formulated anthranilic esters are then added.


72" dia., 18' high stainless steel vacuum pan
22,000 gal storage vats
Pump
CANNING LINE
Filler
Seamer
Canned juice to cooler, casing-warehouse
Bottled juice to cooler, labeler, casing then warehouse
BOTTLING LINE
Pump
Stainless steel intermediate blending tanks
Pump
Filler
Capper

It's faster with headroom high . . . **. . . step low**

STANDING straight up, salesman as well as customer can easily select food items for immediate delivery.

SINGLE low step makes salesman's job less tiring, and it's more inviting to customers entering truck.

Step-In Drive Trucks Spark Sales

Meat-product distributor serving Detroit-area retailers finds decided advantages in new route van's greater headspace, easier handling

INCREASED sales, greater ease of operation, and more positive refrigeration are major advantages resulting from the fleet modernization effected by the Peters Sausage Co. These improvements came with the adoption of new step-in drive trucks with Kold Hold plates, replacing conventional chassis that used water-ice refrigeration.

The company delivers prepared meats in Detroit and the surrounding area. Its line consists of 30 luncheon meats, 10 smoked meats, canned ham, lard, corn meal mush, and pigs' feet in jars. Sales of these items mainly are made to independent meat and grocery stores and delicatessens catering to the "higher-class" trade.

Dodge step-in drives, with insulated bodies, are the new trucks added to the fleet. They have a clear inside height sufficient for a man to stand up and move around without stooping over. It is this stand-up height, plus the easy one-step front entrance door characteristic of the step-in drive design, that have helped increase the route sales.

Buyers Can Browse

Store owners are able to enter the truck body and select the items that they think will sell well—in much the same manner as housewives browse around a store before they make a final selection from a variety of commodities. This was not possible with the old type bodies because of their insufficient headroom and the inconvenience of the rear door entrance after climbing up two or three steps.

The company reports that this new selling technic has tended to boost sales on all of the delivery routes on which they have been used. One salesman who covers 35 stores daily in the Dearborn area just outside of Detroit, is reported to have increased his commissions $18 a week since he started using the new type truck.

Called a route van in the trade, this new truck has a greater ease of operation resulting from its inherent design. The driver enters his driving compartment from either side of the truck by simply taking one step up from the sidewalk through sliding doors. These doors can be left open when the truck is moving from one stop to the next, if the driver so desires.

With the old style trucks having cabs separate from the bodies, it was necessary for the drivers to take at least two steps into the cab and to close the cab doors between every stop. A greater loading volume also can be obtained with the new vehicle, because the body is carried forward over the engine instead of having the engine out in front, as in the conventional chassis.

Easy Handling

The latter feature of design permits a greater body volume on a shorter wheelbase. And the shorter the wheelbase, the greater is the ease of operation, particularly in parking on congested streets.

The Kold Hold plates used on the new vans provide a more certain, more convenient, and less expensive means of refrigeration than the wet ice used on the old trucks.

To date the company has five of the new vans in service. Two more, now being processed, will enter the route sales service as soon as completed.

The vans are of two sizes—one with a body 7½ ft. long and the other with a body 9½ ft. long. Still others, planned for the future, will have 12½ ft. bodies for wholesale deliveries.

At present, the company operates 27 route-sales trucks. Besides the 5 new Dodges, there are 22 conventional trucks, 19 of them with Kold Hold plates and 3 with ice-cooled bodies. In addition, 5 spare trucks are on reserve, 4 with Kold Hold plates and 1 with ice cooling.

Recharging Systems

All except three of the truck bodies with Kold Hold plates have the plates recharged from the ammonia refrigeration system of the Peters plant. The three not so serviced have their own individual refrigerating units on the truck chassis with electric plug-in connections for over-night recharging. None of the new vans carries its own unit.

The ice-cooled trucks are the oldest in the fleet. Eventually, they all will be replaced by route van trucks with Kold Hold plates.

The new vans come as a complete unit of chassis and metal panel body, but the body is neither insulated nor refrigerated. Hence the first step is to convert the standardized production unit into a serviceable refrigerated vehicle. The sausage company had this done by the Proctor-Keefe Body Co., a Detroit truck-body builder.

First, a transverse body bulkhead with a door was added. This bulkhead is located directly behind the driver's seat. Bulkhead and floor, side walls and rear end were then insulated with 4 in. of Fiberglas and the roof with 6 in. of Fiberglas.

This construction provides a completely-insulated compartment, closed at the rear and entered through the door in the front. The door itself is of full height—of the insulated ice box type—and 27 in. wide. It is hinged on the side nearest the driver's seat and opens outward into the driver's compartment, away from the sliding door on the curb side of the truck.

Inside the compartment, directly behind the insulated door, is an open step-in working area facing three levels of removable horizontal shelves, on which the meat products are carried. All made of maple, the lower shelf is 19 in. above the floor, the middle shelf 15 in. above the lower shelf, and the top shelf 15 in. above the middle one.

An electric dome light is located inside the refrigerated compartment on the ceiling of the step-in working area. This light, which illuminates the working area and the meat products carried on the shelves, is automatically lit and turned off by the opening and closing of the bulkhead door. The space beneath the lower shelf is used to store fresh meats, packages, and the wire delivery baskets used by the driver-salesman to carry the orders from the truck into the store.

Refrigerating System

The Kold Hold plates refrigerating the compartment are located crosswise of the compartment at the rear, near the ceiling, with an air baffle plate ahead of them. The baffle helps to circulate the cool air throughout the compartment and prevents the meats carried on the shelves from touching the plates. The ammonia intake and outlet valves used to recharge the plates are located on the front compartment bulkhead—inside the driver's compartment, near the ceiling above the driver's seat. In this position the mechanic attaching the ammonia lines can stand erect instead of kneeling.

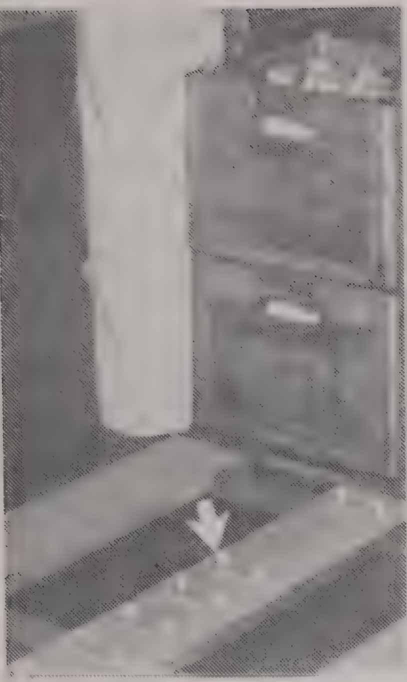
And short body is boon in driving, parking

Peters
Shore Farms Brand
Sausage
PETERS
ROUTE VAN

VAN handles much easier in traffic, parking. Credit goes to short wheelbase of compact, yet roomy, vehicle.

"No-Topple" Palletizing Slashes Handling Costs

Boston dairy effects 75 percent saving in moving, storing bottled milk. System adaptable to other open-case goods



With new cleats . . .

. . . and clamps

—cases go on and off truck safely

—storage is simple, space-thrifty

A SYSTEM employing palletized unit-loads handled by electric fork-lift trucks can effect marked savings in man-hours and man-power in transporting cases of milk, both in bottling plants and at distributing stations.

This has been notably demonstrated by the Whiting Milk Co., large Boston milk processor. Experience over nearly two years shows economies of approximately 75 percent in time and men required to load trailers at the bottling plant. And a similar saving is made at the distributing centers.

How They're Held

Securing the cases to pallets to prevent shifting or side-slip was overcome by company engineers when they devised special cleats (see photo). Fastened to the middle piece of a 3-stringer single-faced pallet, they engage the underside of the milk cases.

In addition, a special clamp was developed to prevent the 5-layer-high piles of filled or empty cases from toppling. This clamp fastens together the cases forming the top layer of the unit load.

Pallets have been standardized at $31\frac{1}{4}$ x $37\frac{1}{2}$ in. This permits loading distribution trailers with pallets two abreast and eight deep. Cases of square bottles are loaded six to a layer, while cases of rounds are placed four to a layer. Average weight of a unit-load of 30 cases of filled square bottles is slightly in excess of 1,500 lb.

Here's how the system operates: At the bottling plant, cases of filled bottles are conveyed from the filling room to the loading platform, where they are placed on pallets. Care is exercised to arrange the bottom layer of each load so that the cases engage the special cleats on the middle stringer of the pallet. When fully loaded, the top layer of cases is fitted with the holding clamp.

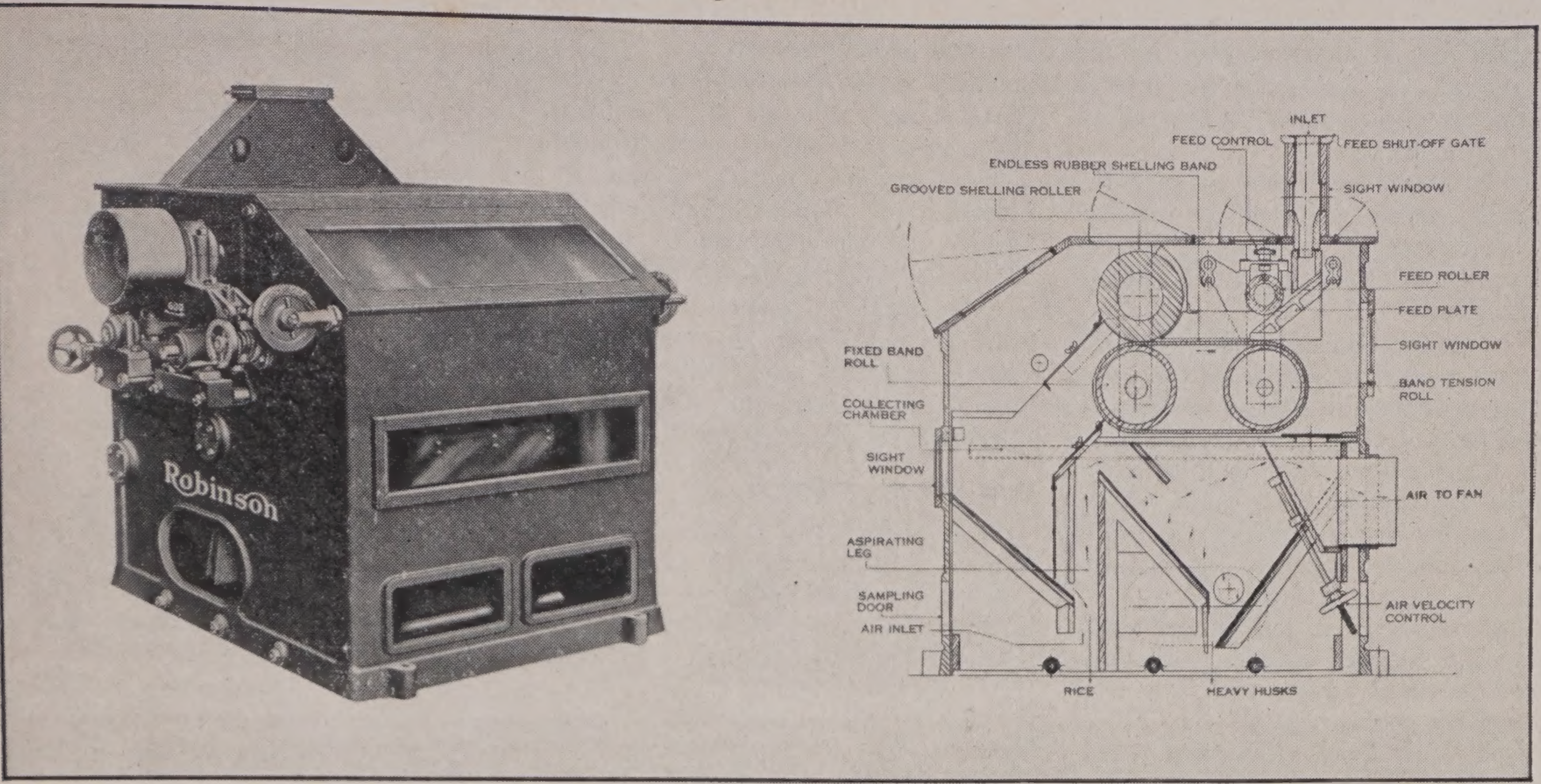
Savings Detailed

By using fork-lift trucks and pallets, a trailer can be loaded in 15 min., whereas, when hand trucks were used, approximately 1 hr. and two or three men were required.

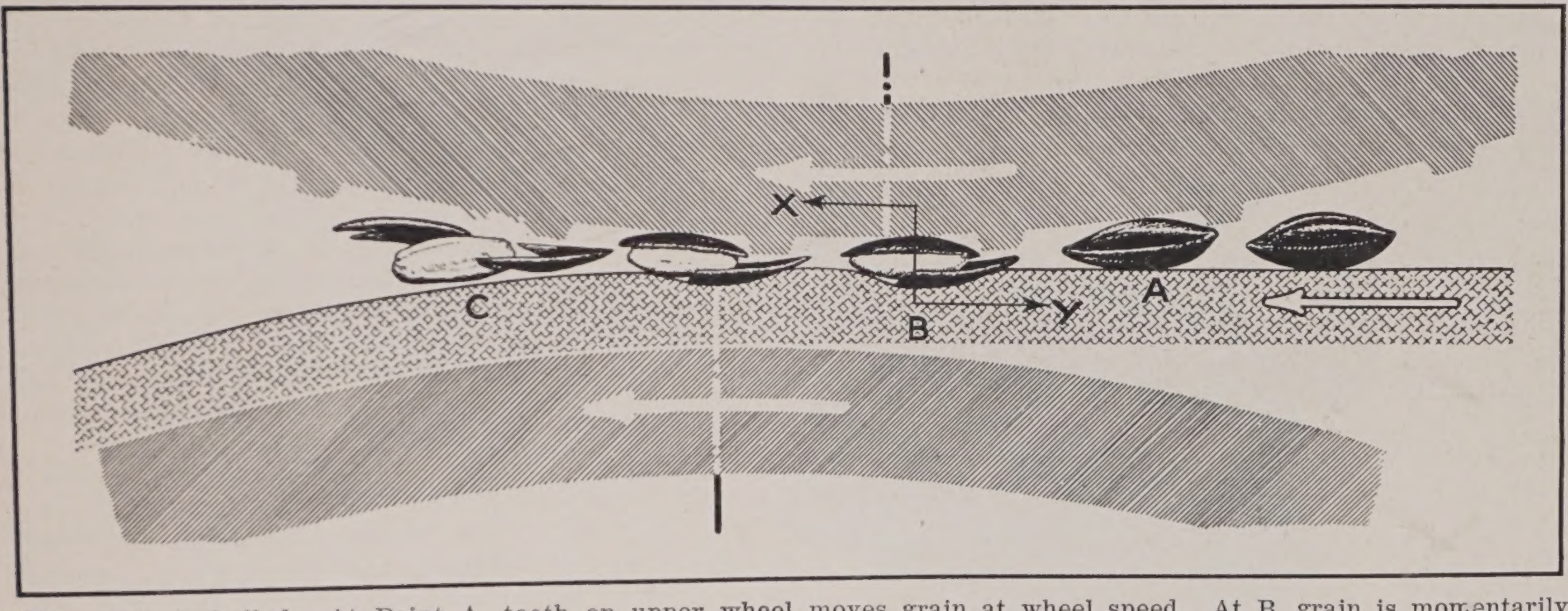
Then, at the distributing center, the loaded pallets are removed from the trailer by a fork truck and stored in the refrigerator. The trailer, after being filled with pallet loads of cases of empty bottles, returns to the main bottling plant. The entire operation at the distributing center takes one man with one truck approximately 30 min., as contrasted with the previously required 1 hr. for three men.

In addition to the notable savings in time and labor, electric fork-lift-pallet handling of milk in cases is reported to have brought these extra advantages: It decreases bottle breakage and loss of products, it reduces traffic congestion on the loading dock, and it conserves space for storage and other essential uses.

Huller, Its Parts, and Details of Shelling Action


Robinson
INLET
FEED CONTROL
FEED SHUT-OFF GATE
ENDLESS RUBBER SHELLING BAND
GROOVED SHELLING ROLLER
SIGHT WINDOW
FEED ROLLER
FEED PLATE
SIGHT WINDOW
FIXED BAND ROLL
BAND TENSION ROLL
COLLECTING CHAMBER
SIGHT WINDOW
AIR TO FAN
ASPIRATING LEG
SAMPLING DOOR
AIR INLET
AIR VELOCITY CONTROL
RICE
HEAVY HUSKS

HERE is the new hulling machine. And its various component parts are depicted in drawing on right, where arrows indicate direction of travel of grain through unit and points of collection of both the shelled rice and husks.



HOW grain is hulled. At Point A, tooth on upper wheel moves grain at wheel speed. At B, grain is momentarily held in rubber belt and the forces, X-Y, function to remove hull. Shelled grain and husks are thrown off belt at C.

High-Vitamin Grain Milled by New Units

Rice retains more of its mineral and Vitamin B content when hulled and whitened by machines that reduce germ breakage. Equipment was developed in England

PAUL WEST

British Information Services, New York City

With photos and drawings, courtesy The Allied National Corp., Ltd., Buying Agent

Incorporating new principles which depart from traditional rice milling, two new machines — the Wemanco huller and whitener—are now turning out a grain that scores exceptionally high in vitamin retention. Now in use in Iraq, units are being supplied to the Netherlands East Indies and other rice producing countries. And in the United States this same equipment—under the name, Moulsdale Brown Rubber Rice Sheller—is being employed by a number of rice millers in Texas, Louisiana, Arkansas, and California.

It was Thomas Robinson & Son, Ltd., Rochdale, Lancashire, England, that developed the new vitamin conserving equipment. The machines used in the U. S. are made and dstributed by H. T. McGill, Houston, Tex.

More than half of the world's population lives on rice, the staple diet of many Asiatic countries. Paddy rice has a lower nutritional value than grain, but it contains starch, minerals and—most important of all—vitamin B. Years of research have proved this vitamin to be indispensable in the prevention of the paralytic disease known as beri-beri, so widespread in Eastern countries.

It is, therefore, essential that the valuable substances should be retained in the rice as far as possible during the milling of the grain for human consumption.

Rice-milling consists mainly of the hulling and whitening processes. The latter is known in some countries as pearling, polishing or scouring. Hulling removes the coarse, inedible husks which have no nutritional value. After hulling, the rice is whitened, a process which imparts the brilliant "pearliness" to the rice grains.

The conventional, mechanical methods of hulling and whitening, however, have the disadvantage that they tend to rob the paddy rice of some of its mineral and vitamin B content. These valuable constituents are contained in the germ and in the thin aleurone layer of the bran. Hulling normally causes the germ to break.

Tests have shown that a considerable amount of the germ is lost in this way—as much as 95 percent in some instances. In the subsequent whitening process, a large proportion of the aleurone layer is removed, so that the finished, highly-polished rice hardly contains any minerals or vitamin B. What remains is only a starch product.

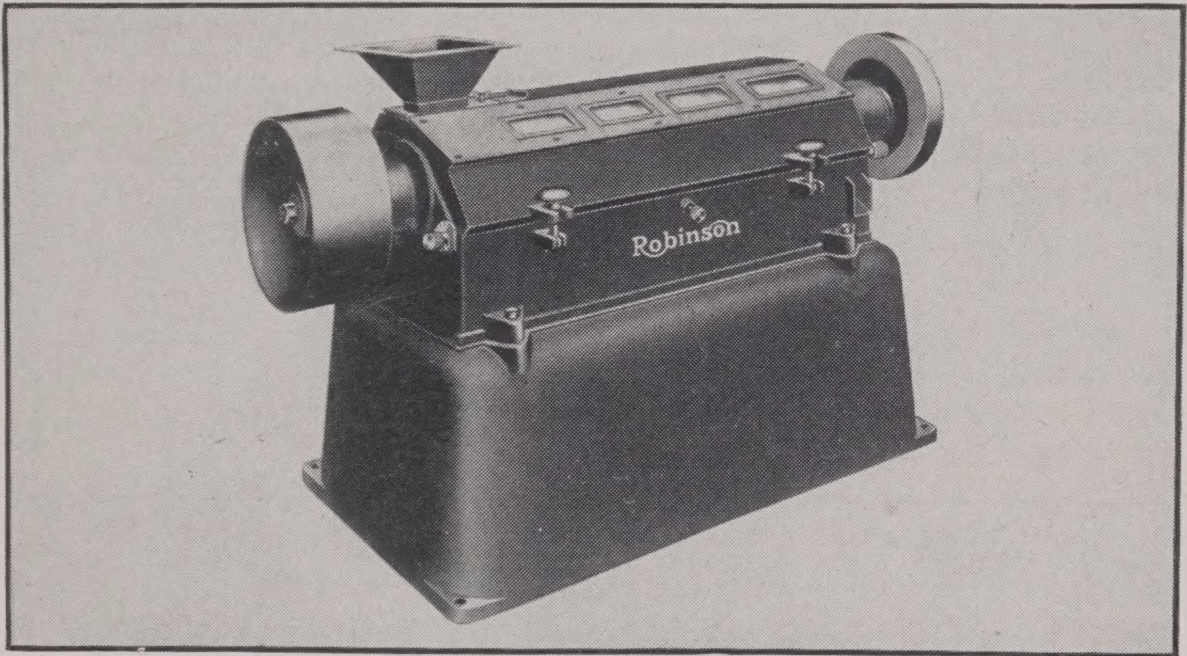
It is obvious, therefore, that the invention of improved methods of hulling and whitening augurs well in the interests of the rice-eating peoples of the world. Thomas Robinson & Son has succeeded in constructing milling machines that minimize the inroads made upon the mineral and vitamin B content of the grain.

Germ Breakage Reduced

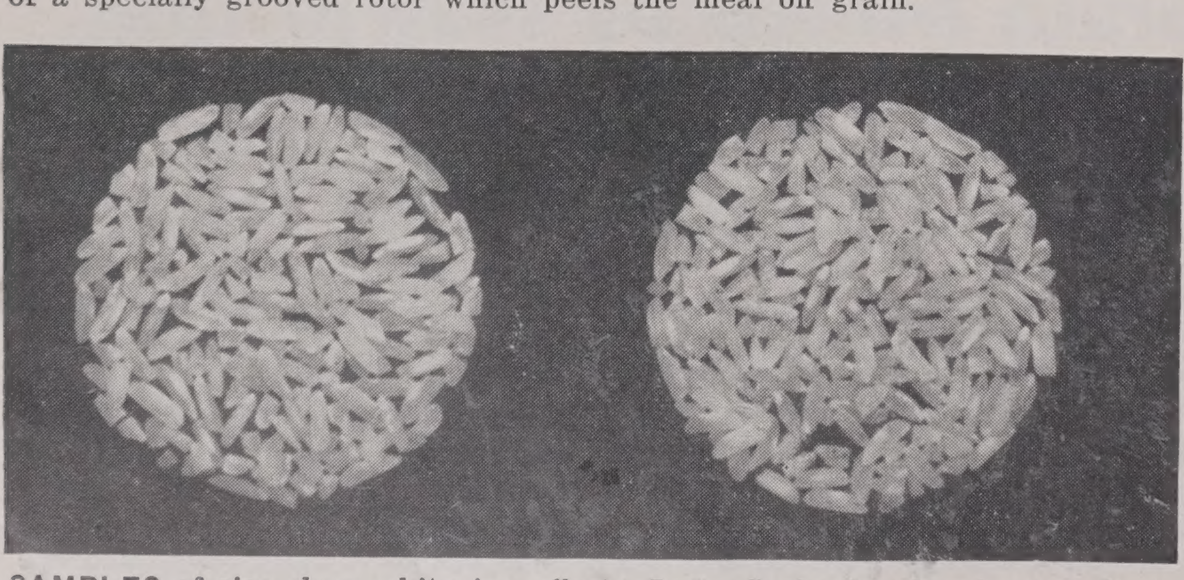
One of these machines is the Ideal Huller, in which only a very small percentage of the germs break. This is due to the fact that the machine does not depend upon the use of milling stones or abrasives, but uses a combination of rubber and metal. Moreover, the husk is removed in a single operation. The remaining treatment of the rice grain is replaced by gentler methods.

Rice entering the huller passes through a feed roller to a continuous 31½-in.-wide rubber belt, whereon it travels in a continuous layer of grains (across the full width of the belt) into the shelling area (see detail sketch of hulling action).

Polishing Unit and Samples of Whitened Grain



WHITENING, or polishing, of rice is accomplished in this machine by action of a specially grooved rotor which peels the meal off grain.



SAMPLES of rice show whitening effect. Left: Grain that has been through machine once. Right: Twice through. Degree of polish may be controlled.

As each grain reaches the shelling area—seen at Point (A) in the sketch—it is entrained in a notch in the grooved shelling roller (fast roll). Here, it is firmly gripped by the tooth behind and starts to move at the speed of the roll. The lower surface of the grain meanwhile is being pressed into partial embedment in the resilient rubber belt.

At first contact, the band deflects readily, since pressure is light and the grain slips easily over the rubber. However, as the grain approaches Point (B), it becomes embedded more deeply in the belt. And resistance to deflection increases very rapidly, until the lower hull on the belt is momentarily held from slipping.

Forces X=Y (see sketch), acting in opposite directions, function at this point and cause the leading edge of the grain to be forced through the hull. Shelled grains and hulls are then thrown off the band at Point (C) and go into a collecting chamber.

From the bottom of the collecting chamber, hulls and grain pass into an aspirating leg. Here, the heavier grain continues to fall, but the hulls are carried over into a second collection point.

In this way, every ripe grain, irrespective of size or shape, may be hulled. The delicate tips of the grain do not get chipped. Moreover, none of the endosperm is crushed or lost, and even protruding germs remain intact. The machine is capable of hulling 1 ton of rice an hour.

Polishing the Grain

The second machine is the Ideal Whitener, a polishing machine operating on an entirely new principle. The whitening is carried out by means of a specially grooved rotor, the movement of which causes the meal to be peeled off the rice grain. At the same time, the mass of rice is subjected to a friction-process by a rapid pulsating movement. Throughout the entire treatment, the rice is safeguarded from any undue pressure, so that the percentage of breakage is very low. The finished rice leaves the machine with an attractive, white pearliness.

By means of a special regulating device, the degree of polish may be varied according to requirements. Should a few rice grains remain unpeeled in the machine, the husk residue may be disposed of by the action of the motor. The machine is capable of handling 1,000 to 1,500 lb. of rice an hour, and it boasts a very low current consumption. The unit is enclosed in a dust-proof metal casing.

We Think . . .

■ Other Processors Can Take a Tip From Progressive Bakers

It is clear to those who attended the recent bakery convention and equipment show in Atlantic City that the baking industry is doing something about its problems. It is finding the answers through new and improved machines.

The principal problems spurring the bakers to progress are common to many other branches of the food industry. The prices of raw materials—such as flour, shortening, sugar and frozen eggs—have increased in recent months, surpluses notwithstanding. Such is the effect of government price-support activities.

Labor, both in production and distribution, has risen 10 to 15 percent for some bakers, and is still tending upward as more and more unions demand pension plans and other social benefits. Increases in these two major cost items are enough to start the bakers seeing red ink, but freight rates and other items have gone up, too. With these higher costs pushing against consumer price resistance—abetted by allegations on the part of government officials that bakers could cut prices—the industry finds itself in a nice profit squeeze.

Then there are two other burrs under the baker's saddle. One is pressure on the part of health officers for an even higher level of cleanliness in bakery plants. The other is competition from prepared mixes, which the bakers say are increasing baking in the home and taking business away from them.

These conditions, in the opinion of a prominent midwestern baker, add up to this: "Either we modernize or we go out of business." Another baker says the same thing in different words: "If we do not modernize, we cannot absorb increasing costs without raising prices—and that would be disastrous today, with competition keener than at any time since the prewar days."

These are strong statements from an industry which enjoyed a production increase of more than 40 percent in ten years, and which still is running at a high level. But they are statements based upon a realistic view of current conditions. And they apply quite as much to some other branches of the food industry as they do to baking.

But as we said, leading bakers are doing something about it. They are spending money to save money. One, for example, indicated during the meeting at Atlantic City that he was investing $250,000 in new machines. And one equipment exhibitor said that he booked orders totaling $200,000 in one afternoon at the show.

The bakers are laying out this money for machines which perform operations formerly done by hand, such as depanners and pan greasers; for machines with higher production capacity, including wrappers that handle up to 75 loaves of bread a minute and a new mixer that puts cake batter production on a continuous basis; as well as for "sanitized" equipment which meets the requirements of health department inspectors. Equipment manufacturers have done a good job of meeting the bakers' requirements. One alone has eight different new and improved machines.

So there is no cause to worry about the future of progressive bakers. But those who try to get by with antiquated plants are in for trouble. And other food processors might well take a tip from bakers on how to solve their problems.

■ F&DA Takes Step Foward in New Regulation

Experimental distribution of foods that do not comply strictly with standards of identity will be allowed under a new regulation of the Food & Drug Administration. Temporary permits will be issued to legalize this departure from normal requirements under clearly defined conditions which were announced in mid-October.

This action is an answer to the frequently made charge that the system of food standardization applied by F&DA is an impediment to progress. We doubt whether it has ever been a really serious obstacle. But it must at times have discouraged executives when their research men proposed changes in foods subject to standards of identity. And it is well to have that situation corrected.

Now the question is: Will the new rules work well? We believe they will. But they will require a real spirit of cooperation between industry and government.

On the part of industry, there must be a careful and conservative approach to novelty in order to demonstrate fully "the basis upon which the (new) ingredient is believed to be wholesome and nondeleterious."

In return, government must take a sympathetic attitude toward new developments—whether or not they seem particularly attractive to officials—so long as they are safe. And if there be careful and adequate preparation of proposals by industry, the government can be expected to give sympathetic consideration.

Which puts the first move toward successful application of the new regulation squarely up to food processors.

■ Prepackaging Should Be a Phase of Food Processing

Prepackaging is here to stay. Consumers like it, and retailers find that it reduces their selling costs by facilitating self-service. In fact, it has caught on so fast and so solidly, that packaging experts and technologists who must solve the problems are in somewhat the same position as the man who has a bear by the tail.

From the viewpoint of consolidating efforts and brains to work out the problems, the prepackaging industry is to be complimented on holding its first convention, in October, and also on forming an association. We do question, however, the soundness in setting up a separate prepackaging group, because many of the problems are so closely associated with food packaging in general that a pooling of activities with an existing packaging association might have produced better results.

Be that as it may, fruit, vegetable and meat processors have a stake in prepackaging and should closely watch it in the months and years ahead. It offers competition to canners and perhaps presents an opportunity for some of them near population centers. As the demand for prepackaged products grows—and it is skyrocketing—the volume involved will make prepackaging plants feasible and open a new area for processors. Certainly, for highest efficiency and lowest cost, prepackaging should be done on a mass-production basis.

A&P's Atlantic Commission Co. has amply demonstrated the feasibility of a plant for grading, washing and prepackaging produce.

The larger meat packers are keenly interested in the prepackaging of meat, and some of them are wrapping luncheon meats and sausage products especially for the self-service stores. Fresh meat cuts, however, present so many problems that the packers shy away from prepackaging them. Yet large retailers are likely to press for prepackaging of such products by packers. And the first meat company to offer such service will have quite an advantage over competitors.

We think that prepackaging is destined to become an industry. And it should be a part of the food processing field—not a retailing, wholesaling or farming function carried out by inefficient methods and without proper technical control.

Pension Plans Benefit Company as Well as Employees

Regardless of union demands, pension plans for workers should be given careful consideration by the food processing firms that have not adopted them.

Seasonal workers, of course, would have to be excluded from such a plan, but even a seasonal business has a year-'round core of employees. And a small corporation might not be able to meet the costs of a fixed pension plan through the bad years of a business cycle without wiping out its surplus.

But a pension plan can be geared to profits. That is, a certain percentage of profits can be used to build pension funds. This arrangement has the added advantage in good years of taking a large part of the pension cost out of income which otherwise would be lost through taxes. Further, workers may put forth a little more effort if they know they are sharing somewhat in the profits from their proficiency.

A pension plan is a great builder of better employee relations. It allays one of the most common of all fears on the part of workers—that they will be embarrassingly dependent upon some one else in their declining years. Consequently, there are warm spots in the hearts of employees for the firm which provides for their support when they no longer can do a hard day's work. And if there is anything business needs in these days of union domination of labor, it is warm spots in the hearts of employees.

In addition to improving employee-worker relations, pension plans—like company-sponsored group insurance—reduce the labor turnover. A valued employee will think twice before he walks out on security in his old age. And the longer he stays with you, the longer he is likely to stay—giving you the continuing benefit of his accumulated experience.

Anyway, if industry doesn't provide security for workers, the government will do it—and will tax corporations to cover the cost. So either way, industry will pay. How much better to do it directly and improve employee relations, while at the same time helping to stem the dangerous trend toward a welfare state in this country.

Packaging Machine Makers Have Challenge to Meet

Need for low-cost transparent packaging films which are gas-tight was pointed out in an editorial in our September issue. This represents a challenge to manufacturers of packaging materials, and with the progress being made in packaging films, there is reason to expect that the challenge will be met.

But this brings up a second phase of the problem of effective and efficient packaging of foods in transparent films. It is the need for machines which will fill and seal flexible packages at a rate of 60 to 90 a minute or more without too many imperfect seals, or pinholes resulting from handling by the machine.

There are tremendous possibilities in the field of food packaging for gas-tight flexible packages filled and sealed at high production rates by automatic packaging machinery. At the moment, the odds are that progress will come faster in films than in machines. But the one without the other is of little value to processors of low-cost foods who must attain high rates of production per man to keep costs in line.

Large food companies with well-staffed engineering departments may work out their own answers. And smaller firms can at least make their need known to the companies from which they buy equipment.

Survey Proves Housewives are Finicky, Fickle and Scotch

An interesting insight into consumer preference for brands of processed foods is brought to light by the *Philadelphia Bulletin's* study of the market in its area. In buying frozen foods, consumers favored a leading brand, long established and with an unquestioned reputation for high quality. They favored it, that is, except in one instance.

This leading brand rated 11 to 1 against the nearest competitor in frozen vegetables, meats and poultry, and the ratio was 15 to 1 for fruits and berries. But when it came to frozen concentrated orange juice, a new brand was five times as popular as the old frozen-food brand. Both brands of juice were of top quality, but the new brand sold for a little less. Of course, the frozen concentrate is relatively new, so the well-known brand had not become established for this particular product.

This seems to demonstrate two things: An old brand does not carry its customary weight when put on a new product, because the housewife makes her own quality evaluation. And given two products of about equal quality, the consumer will take the one that costs less, regardless of the brand.

No processor ever can rest on his laurels.